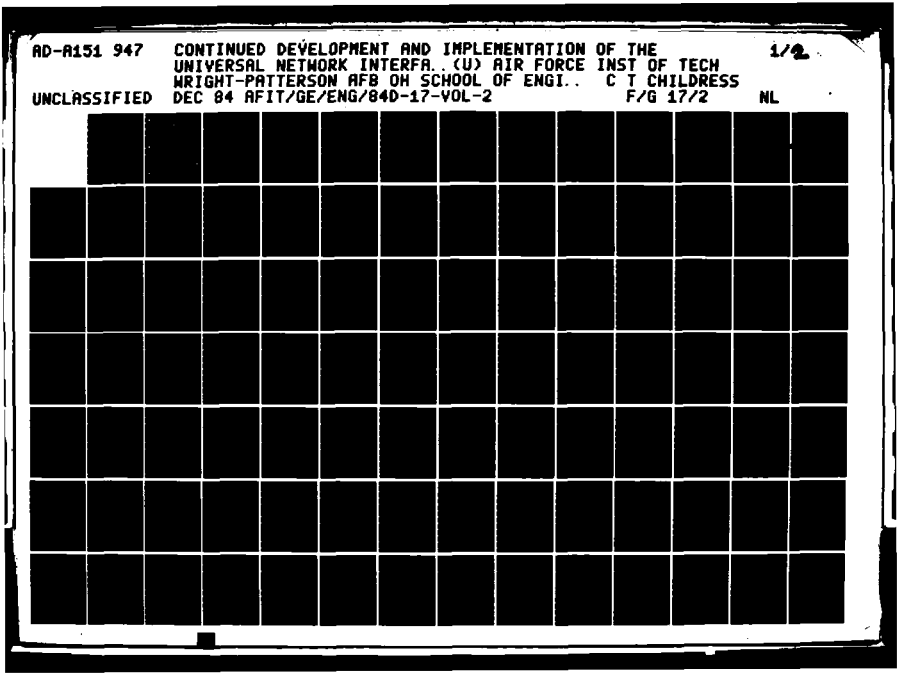
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CONTINUED DEVELOPMENT AND IMPLEMENTATION OF THE
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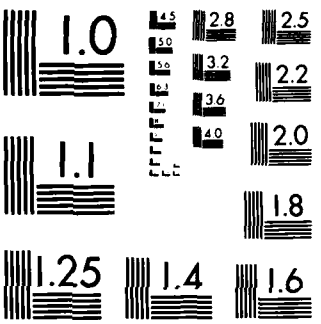

CONTINUED DEVELOPMENT AND IMPLEMENTATION
OF THE
UNIVERSAL NETWORK INTERFACE DEVICE (UNID) II
IN THE
DIGITAL ENGINEERING LABORATORY NETWORK (DELNET)
VOL II OF II

THESIS

AFIT/GE/ENG/84D-17 Creed T. Childress, Jr.
Captain USAF

DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY
AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

AFIT/GE/ENG/84D-17

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CONTINUED DEVELOPMENT AND IMPLEMENTATION OF THE UNIVERSAL NETWORK INTERFACE DEVICE (UNID) II IN THE DIGITAL ENGINEERING LABORATORY NETWORK (DELNET) VOL II OF II

THESIS

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CONTINUED DEVELOPMENT AND IMPLEMENTATION OF THE UNIVERSAL NETWORK INTERFACE DEVICE (UNID) II IN THE DIGITAL ENGINEERING LABORATORY NETWORK (DELNET) VOL II OF II

THESIS

Presented to the Faculty of the School of Engineering

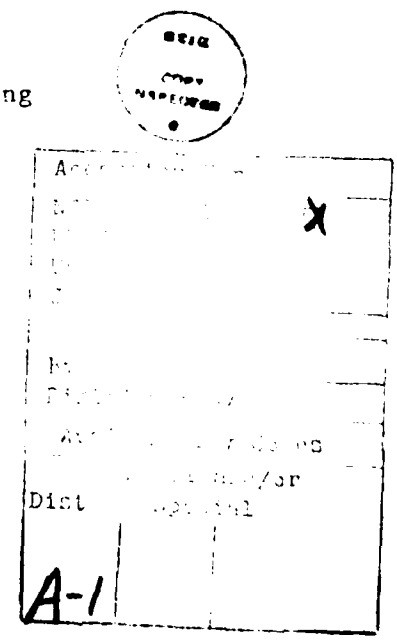
of the Air Force Institute of Technology

Air University

in Partial Fulfillment of the

Requirements for the Degree of

Master of Science in Electrical Engineering



Creed T. Childress, Jr., BS EE, BS IOE

Captain, USAF

December 1984

Appendix H

Software Listings

This appendix contains the compiled listings of the programs used in this development effort. The list begins with the data link and network simulations followed by the validation and test software used with the UNID II and the NETOS. The simulated host software for the CP/M system follows next with the listing of the SBC 544 monitor concluding the appendix.

This appendix is subdivided into six sections which are listed as follows:

1. Data Link Layer Simulation

The purpose of this program is to simulate the data link layer software on the Intel Series III software development system.

```
 ISIS-II PL/M-86 V2.1 COMPILATION OF MODULE MAIN
OBJECT MODULE PLACED IN NETNEW.OBJ
COMPILER INVOKED BY:  PLM86 NETNEW.U2

            $TITLE('UNID II NETWORK TEST PROGRAM, 30 SEP 84')
            $XREF OPTIMIZE(2)

            /*************************************************************/
            /*                                                           */
            /*  DATE:       30 Sep 84                                    */
            /*  VERSION:    1.0                                          */
            /*                                                           */
            /*  TITLE:      UNID II Network Simulation Program           */
            /*  FILE NAME:  NETNEW.U2                                    */
            /*  OWNER:      C. T. Childress                              */
            /*                                                           */
            /*  SOFTWARE SYSTEM: Intel Series III, ISIS II (V 4.2, 4.3)  */
            /*  USE:        Simulate the function of the data link layer */
            /*              on the Intel Series III software development  */
            /*              system.                                      */
            /*                                                           */
            /*  CONTENTS:   Listing for the data link layer simulation.  */
            /*                                                           */
            /*************************************************************/

            /*****************************************************************
            PROLOGUE - MODULE N.MAIN$U2          DATE TRANSLATED:  5 APR 84
                                                 DATE LAST MODIFIED: 30 SEP 84, 1400 HRS

                THE PURPOSE OF THIS MODULE IS TO PROVIDE THE UNID II NETWORK OPERATING
            SYSTEM (N.OS) WITH THE MAIN LINE OF PROCESSING.  THE N.OS IS REQUIRED TO
            INPUT AND OUTPUT DATA PASSED TO IT FROM FOUR LOCAL CHANNELS OR RECEIVED FROM
            EITHER NETWORK CHANNEL A OR B.
                THIS MODULE CONSISTS OF THE MAIN LINE PROCEDURE 'MAIN', AND PROCEDURES
            INIT$N$TAB, DET$DEST$ONE, DET$DEST$TWO, DET$DEST$LN, LD$TAB$HSKP,
            SRVC$TAB$HSKP, BUILD$I$FRAME, BUILD$S$FRAME, ROUTE$IN, ROUTE$OUT,
            TIME$DELAY$CHA, AND TIME$DELAY$CHB.
            *****************************************************************/

1           MAIN:  DO;

            /***************  EXTERNAL PROCEDURES FOR ISIS SYSTEM CALLS *************/

2   1       DQ$DECODE$EXCEPTION:    PROCEDURE (ERRNUM, EXCEPTION$P, STATUS) EXTERNAL;
3   2                               DECLARE ERRNUM WORD;
4   2                               DECLARE (EXCEPTION$P, STATUS) POINTER;
5   2                               END DQ$DECODE$EXCEPTION;

6   1       DQ$CLOSE:   PROCEDURE (AFTN, STATUS) EXTERNAL;
7   2                   DECLARE AFTN WORD, STATUS POINTER;
```

```
 8  2                 END DQ$CLOSE;
 9  1       DQ$DETACH: PROCEDURE (CONNECTION, EXCEPT$P) EXTERNAL;
10  2                 DECLARE CONNECTION WORD, EXCEPT$P POINTER;
11  2                 END DQ$DETACH;

12  1       DQ$EXIT:  PROCEDURE (COMPLETION$CODE) EXTERNAL;
13  2                 DECLARE COMPLETION$CODE WORD;
14  2                 END DQ$EXIT;

15  1       DQ$ATTACH: PROCEDURE(PATH$P, STATUS) WORD EXTERNAL;
16  2                 DECLARE (PATH$P, STATUS) POINTER;
17  2                 END DQ$ATTACH;

18  1       DQ$CREATE: PROCEDURE (PATH$P, STATUS) WORD EXTERNAL;
19  2                 DECLARE (PATH$P, STATUS) POINTER;
20  2                 END DQ$CREATE;

21  1       DQ$OPEN:  PROCEDURE (AFTN, MODE, NUM$BUF, STATUS) EXTERNAL;
22  2                 DECLARE AFTN WORD, STATUS POINTER;
23  2                 DECLARE (MODE, NUM$BUF) BYTE;
24  2                 END DQ$OPEN;

25  1       DQ$READ:  PROCEDURE (AFTN, BUFFER, COUNT, STATUS) ADDRESS EXTERNAL;
26  2                 DECLARE (AFTN, COUNT) WORD;
27  2                 DECLARE (BUFFER, STATUS) POINTER;
28  2                 END DQ$READ;

29  1       DQ$WRITE: PROCEDURE (AFTN, BUFFER, COUNT, STATUS) EXTERNAL;
30  2                 DECLARE (AFTN, COUNT) WORD;
31  2                 DECLARE (BUFFER, STATUS) POINTER;
32  2                 END DQ$WRITE;

33  1       DECLARE (ACTUAL, STATUS) ADDRESS;
34  1       DECLARE STATUS$PTR (81) BYTE;
35  1       DECLARE BUFFER (128) BYTE;
36  1       DECLARE (R$CONN, W$CONN) ADDRESS PUBLIC;
37  1       DECLARE CR          LITERALLY '0DH',
                 LF          LITERALLY '0AH';
38  1       DECLARE CR$LF (2) BYTE DATA (0DH, 0AH);
39  1       DECLARE     MESSAGE(*) BYTE DATA(0DH, 0AH,
         'THIS IS THE TEST MESSAGE                    THIS IS THE TEST
                                          MESSAGE!!!!!');

         /***************************** END EXTERNALS *****************************/

40  1       DECLARE
                 FALSE       LITERALLY '0H', /* USE AS FLAGS TO TEST */
                 TRUE        LITERALLY '0FFH', /* BITS FOR BRANCHING */
                 CONCTC      LITERALLY '0D5H', /* NETWORK MONITOR CTC PORT ADDRESS */
                 CONCMD      LITERALLY '0DFH',
                                   /* NETWORK MONITOR USART COMMAND PORT ADDRESS */
```

```
        CONDAT      LITERALLY '0DEH',
                        /* NETWORK MONITOR USART DATA PORT ADDRESS */
        NET$RI$DEST$ERR LITERALLY '10', /* NET ROUTE$IN DEST ERROR ENTRY */
        NET$RO$DEST$ERR LITERALLY '11', /* NET ROUTE$OUT DEST ERROR ENTRY */
        PACKET$SIZE     LITERALLY '133', /* PACKET IS 133 BYTE BLOCK */
        PACKETS$IN$TABLE LITERALLY '10', /* # PACKETS IN TABLE */
        PACKET$TABLE$SIZE LITERALLY '1330',
        FRAME$SIZE      LITERALLY '135',
        FRAMES$IN$TABLE LITERALLY '10',
        FRAME$TABLE$SIZE LITERALLY '1350',
        DATA$SIZE       LITERALLY '128',
        IP$DATA$SIZE    LITERALLY '96',
        TCP$DATA$SIZE   LITERALLY '72';


        /* NETWORK VARIABLES FOR THIS UNID */

        /* NOTES: 1.  THIS$UNID$NBR MUST REFLECT WHICH UNID THIS IS.
              2.  THIS$COUNTRY$CODE MUST REFLECT THE AREA TO WHICH THIS
              UNID IS LOCATED.
              3.  MAX$COUNTRY$CODE WILL INDICATE WHICH COUNTRY CODES
              ARE CURRENTLY OPERATIONAL.  CC = 0000 IS RESERVED
              FOR THE DELNET MONITOR.
              4.  MAX$NETWORK$CODE WILL INDICATE HOW MANY UNIDS ARE
              CURRENTLY OPERATIONAL WITHIN A PARTICULAR COUNTRY.
              5.  FOR DETAILED INFORMATION ON THE ABOVE, REFER TO
              PHISTER'S THESIS, APPENDIX D.                          */

41  1   DECLARE
        THIS$UNID$NBR LITERALLY '02H',  /* UNIQUE ADDRESS OF THIS UNID */
        THIS$COUNTRY$CODE LITERALLY '01H', /* COUNTRY WHERE THIS UNID RESIDES */
        MAX$COUNTRY$CODE  LITERALLY '01H', /* COUNTRIES CURRENTLY OPERATIONAL */
        MAX$NETWORK$CODE  LITERALLY '03H',
                            /* NUMBER OF UNIDS OPERATIONAL IN CC */
        STAT$NBR   LITERALLY '20',    /* NUMBER OF ENTRIES IN STATUS TABLE */
            /* VARIABLES USED IN THIS SIMULATION   */
        CTCNOA      BYTE,  /* PROGRESSIVE NUMBER OF TIME COUNTS FOR
                              NETWORK CHANNEL A */
        CTCNOB      BYTE,  /* PROGRESSIVE NUMBER OF TIME COUNTS FOR
                              NETWORK CHANNEL B */
        MAXNOA      LITERALLY '3',      /* PREVIOUSLY 64H = 100D */
                   /* MAXIMUM NUMBER OF TIMING COUNTS FOR NETWORK CHANNEL A */
        MAXNOB      LITERALLY '3',      /* PREVIOUSLY 64H = 100D */
                   /* MAXIMUM NUMBER OF TIMING COUNTS FOR NETWORK CHANNEL B */
        RETRANS$A   BYTE,
                   /* PROGRESSIVE NUMBER OF RETRANSMISSIONS OF A FRAME */
        RETRANS$B   BYTE,
                   /* PROGRESSIVE NUMBER OF RETRANSMISSIONS OF A FRAME */
        MAXRETRANS$A    LITERALLY '6',
                   /* MAXIMUM NUMBER OF RETRANSMISSIONS OF A FRAME */
        MAXRETRANS$B    LITERALLY '6';
```

```
                        /* MAXIMUM NUMBER OF RETRANSMISSIONS OF A FRAME */

 42  1      DECLARE BUSYSTATUS  LITERALLY '0FFH',
                    NMBR$MSK    LITERALLY '07H',
                    ESC         LITERALLY '1BH',
                    EOT         LITERALLY '04H';
 43  1      DECLARE ASCII(*)    BYTE DATA('0123456789ABCDEF');
 44  1      DECLARE MSGNUM      BYTE;
 45  1      DECLARE OUT$TAB$FULL  BYTE;


            /*************************************************************************/
            /*  DEFINITIONS FOR THE NETWORK SERIAL INPUT/OUTPUT USARTS               */
            /*************************************************************************/

 46  1      DECLARE
                    BAUD$LSB        BYTE,
                    BAUD$MSB        BYTE,
                    NUM$BYTES$SENT  INTEGER;

                /* MORE TO BE ADDED LATER */

            /*************************************************************************/
            /*  ADDITIONAL GENERAL DECLARES NEEDED FOR THIS PROGRAM                  */
            /*************************************************************************/

 47  1      DECLARE     TIMCHA          BYTE,
                        TIMCHB          BYTE,
                        HSKP$ERR        INTEGER;
                /* MORE TO BE ADDED LATER */

            /*************************************************************************/
            /*  DATA TABLES USED IN THIS PROGRAM                                     */
            /*************************************************************************/

 48  1      DECLARE
                    NT01RX(FRAME$TABLE$SIZE)  BYTE,
                    NT01NS  INTEGER,
                    NT01NE  INTEGER,
                    NT01SZ  INTEGER,

                    NT02RX(FRAME$TABLE$SIZE)  BYTE,
                    NT02NS  INTEGER,
                    NT02NE  INTEGER,
                    NT02SZ  INTEGER,

                    NT01TX(FRAME$TABLE$SIZE)  BYTE,
                    TX01NS  INTEGER,
                    TX01NE  INTEGER,
                    TX01SZ  INTEGER,
```

```
                    NT02TX(FRAME$TABLE$SIZE)  BYTE,
                    TX02NS  INTEGER,
                    TX02NE  INTEGER,
                    TX02SZ  INTEGER,

                    LCNTTB(PACKET$TABLE$SIZE)   BYTE,
                    LCNTNS  INTEGER,
                    LCNTNE  INTEGER,
                    LCNTSZ  INTEGER,

                    NTLCTB(PACKET$TABLE$SIZE)   BYTE,
                    NTLCNS  INTEGER,
                    NTLCNE  INTEGER,
                    NTLCSZ  INTEGER,

                    STATTB(STAT$NBR)    BYTE;

 49   1      DECLARE     FRAME   STRUCTURE(ADDRES  BYTE,
                                           CONTROL  BYTE,
                                           PACKET$DEST BYTE,
                                           PACKET$SOURCE BYTE,
                                           PACKET$SEQ  BYTE,
                                           PACKET$SPAR1 BYTE,
                                           PACKET$SPAR2 BYTE,
                                           PACKET$DATA(DATA$SIZE) BYTE);

 50   1      DECLARE     PACKET  STRUCTURE(DESTIN BYTE,
                                           SOURCE BYTE,
                                           SEQUEN BYTE,
                                           SPARE1 BYTE,
                                           SPARE2 BYTE,
                                           DATAM(DATA$SIZE) BYTE);

 51   1      DECLARE     IPDATA  STRUCTURE(VERS$IHL  BYTE,
                                           TYPE$SERV BYTE,
                                           TOT$LEN1  BYTE,
                                           TOT$LEN2  BYTE,
                                           ID$1      BYTE,
                                           ID$2      BYTE,
                                           FLAG$FRAG BYTE,
                                           FRAGOFF   BYTE,
                                           TIME$LIVE BYTE,
                                           PROTO     BYTE,
                                           CHKSUM$1  BYTE,
                                           CHKSUM$2  BYTE,
                                           SORC$ADDR(4) BYTE,
                                           DEST$ADDR(4) BYTE,
                                           OPTIONS(3) BYTE,
                                           PADDING   BYTE,
                                           DATAM(IP$DATA$SIZE) BYTE);
```

```
 52  1      DECLARE     TCPDATA STRUCTURE(SOURCE$PORT(2)    BYTE,
                                          DESTIN$PORT(2)    BYTE,
                                          SEQUEN$NUM(4)     BYTE,
                                          ACK$NUM(4)        BYTE,
                                          DATA$OFF$PLUS     BYTE,
                                          RESERV$PLUS       BYTE,
                                          WINDOW(2)         BYTE,
                                          CHECKSUM(2)       BYTE,
                                          URGENT$PTR(2)     BYTE,
                                          OPTIONS(3)        BYTE,
                                          PADDING           BYTE,
                                          DATAM(TCP$DATA$SIZE) BYTE);


             /* MISCELLANEOUS DECLARATIONS  */

 53  1      DECLARE
                 FOREVER BYTE,
                 DESTINATION WORD,       /* DESTINATION OF A FRAME */
                 SEQ$BIT$A   BYTE,       /* ACKNOWLEDGE VARIABLE DECLARATIONS */
                 SEQ$BIT$B   BYTE,
                 INPUT$SEQ$BIT$A     BYTE,
                 INPUT$SEQ$BIT$B     BYTE,
                 THIS$SEQ$BIT$A      BYTE,
                 THIS$SEQ$BIT$B      BYTE;

 54  1      DECLARE     STARTUP$HDR(*) BYTE DATA(CR,LF,
                 '                          UNID II #3 NETWORK OS',CR,LF,
                 '                         VERS 1.0,  30 SEP 1984',CR,LF,
                 '                               EXECUTING',CR,LF);

 55  1      DECLARE     TP$1(*) BYTE DATA(CR,LF,
                 'TP$1           ENTERING INIT$N$TAB PROCEDURE');
 56  1      DECLARE     TP$2(*) BYTE DATA(CR,LF,
                 'TP$2           ENTERING INSIO PROCEDURE');
 57  1      DECLARE     TP$3(*) BYTE DATA(CR,LF,
                 'TP$3           STARTING ROUTE$IN - ROUTE$OUT LOOP');
 58  1      DECLARE     TP$4(*) BYTE DATA(CR,LF,
                 'TP$4           ENTERING ROUTE$IN PROCEDURE');
 59  1      DECLARE     TP$5(*) BYTE DATA(CR,LF,
                 'TP$5           INCOMING FRAME LOCATED IN NETWORK CHANNEL A');
 60  1      DECLARE     TP$6(*) BYTE DATA(CR,LF,
                 'TP$6           FRAME IS NT01RX TO NT02TX TRANSFER');
 61  1      DECLARE     TP$7(*) BYTE DATA(CR,LF,
                 'TP$7           DATA IS DESTINED FOR THIS UNID');
 62  1      DECLARE     TP$8(*) BYTE DATA(CR,LF,
                 'TP$8           FRAME IS INCOMING S FRAME');
 63  1      DECLARE     TP$9(*) BYTE DATA(CR,LF,
                 'TP$9           THIS SEQ$BIT$A = 1');
 64  1      DECLARE     TP$10(*) BYTE DATA(CR,LF,
                 'TP$10          THIS SEQ$BIT$A = 0');
```

```
 65  1     DECLARE     TP$11(*) BYTE DATA(CR,LF,
               'TP$11        FRAME IS INCOMING I FRAME');
 66  1     DECLARE     TP$12(*) BYTE DATA(CR,LF,
               'TP$12        INPUT SEQ$BIT$A = 1');
 67  1     DECLARE     TP$13(*) BYTE DATA(CR,LF,
               'TP$13        INPUT SEQ$BIT$A = 0');
 68  1     DECLARE     TP$14(*) BYTE DATA(CR,LF,
               'TP$14        INCOMING FRAME LOCATED IN NETWORK CHANNEL B');
 69  1     DECLARE     TP$15(*) BYTE DATA(CR,LF,
               'TP$15        FRAME IS NT02RX TO NT01Tx TRANSFER');
 70  1     DECLARE     TP$16(*) BYTE DATA(CR,LF,
               'TP$16        DATA IS DESTINED FOR THIS UNID');
 71  1     DECLARE     TP$17(*) BYTE DATA(CR,LF,
               'TP$17        FRAME IS INCOMING S FRAME');
 72  1     DECLARE     TP$18(*) BYTE DATA(CR,LF,
               'TP$18        THIS SEQ$BIT$B = 1');
 73  1     DECLARE     TP$19(*) BYTE DATA(CR,LF,
               'TP$19        THIS SEQ$BIT$B = 0');
 74  1     DECLARE     TP$20(*) BYTE DATA(CR,LF,
               'TP$20        FRAME IS INCOMING I FRAME');
 75  1     DECLARE     TP$21(*) BYTE DATA(CR,LF,
               'TP$21        INPUT SEQ$BIT$B = 1');
 76  1     DECLARE     TP$22(*) BYTE DATA(CR,LF,
               'TP$22        INPUT SEQ$BIT$B = 0');
 77  1     DECLARE     TP$23(*) BYTE DATA(CR,LF,
               'TP$23        PACKET LOCATED IN CONTTB');
 78  1     DECLARE     TP$24(*) BYTE DATA(CR,LF,
               'TP$24        INCOMING PACKET DESTINED FOR CHANNEL A');
 79  1     DECLARE     TP$25(*) BYTE DATA(CR,LF,
               'TP$25        INCOMING PACKET DESTINED FOR CHANNEL B');
 80  1     DECLARE     TP$26(*) BYTE DATA(CR,LF,
               'TP$26        OUTGOING FRAME LOCATED IN NETWORK CHANNEL A');
 81  1     DECLARE     TP$27(*) BYTE DATA(CR,LF,
               'TP$27        FRAME IS NT01TX TO CHANNEL A TRANSFER');
 82  1     DECLARE     TP$28(*) BYTE DATA(CR,LF,
               'TP$28        OUTGOING FRAME LOCATED IN NETWORK CHANNEL B');
 83  1     DECLARE     TP$29(*) BYTE DATA(CR,LF,
               'TP$29        FRAME IS NT02TX TO CHANNEL B TRANSFER');
 84  1     DECLARE     TP$30(*) BYTE DATA(CR,LF,
               'TP$30        DESTINATION OF NT01RX IS NL');
 85  1     DECLARE     TP$31(*) BYTE DATA(CR,LF,
               'TP$31        DESTINATION OF NT01RX IS NN');
 86  1     DECLARE     TP$32(*) BYTE DATA(CR,LF,
               'TP$32        DESTINATION OF NT02RX IS NL');
 87  1     DECLARE     TP$33(*) BYTE DATA(CR,LF,
               'TP$33        DESTINATION OF NT02Rx IS NN');
 88  1     DECLARE     TP$34(*) BYTE DATA(CR,LF,
               'TP$34        DESTINATION$UNID >= THIS$UNID$NBR');
 89  1     DECLARE     TP$35(*) BYTE DATA(CR,LF,
               'TP$35        DESTINATION$UNID < THIS$UNID$NBR');
 90  1     DECLARE     TP$36(*) BYTE DATA(CR,LF,
```

```
408   3              ;       /* ZERO IS NULL AND AN ERROR */
409   3              DO,     /* IF CALLED TO BUILD S FRAME FOR CH A */
410   4                  ADDRESS$WORD = ROL(NTO1TX (TX01NS), 4);
411   4                  IF INPUT$SEQ$BIT = TRUE THEN
412   4                      CONTROL$WORD = 0A0H;        /* CONT$WD = 10100000 */
413   4                  ELSE CONTROL$WORD = 080H;       /* CONT$WD = 10000000 */
414   4                  NTO1RX (NTO1NE+0) = ADDRESS$WORD;
415   4                  NTO1RX (NTO1NE+1) = CONTROL$WORD;
416   4                  DO INDEX = 2 TO (FRAME$SIZE - 1);
417   5                      NTO1RX (NTO1NE + INDEX) = '/';
418   5                  END;
419   4                  CALL LD$TAB$HSKP (1);
420   4              END;

421   3              DO,     /* IF CALLED TO BUILD S FRAME FOR CH B */
422   4                  ADDRESS$WORD = ROL(NTO2TX (TX02NS), 4);
423   4                  IF INPUT$SEQ$BIT = TRUE THEN
424   4                      CONTROL$WORD = 0A0H;        /* CONT$WD = 10100000 */
425   4                  ELSE CONTROL$WORD = 080H;       /* CONT$WD = 10000000 */
426   4                  NTO2RX (NTO2NE+0) = ADDRESS$WORD;
427   4                  NTO2RX (NTO2NE+1) = CONTROL$WORD;
428   4                  DO INDEX = 2 TO (FRAME$SIZE - 1);
429   5                      NTO2RX (NTO2NE + INDEX) = '/';
430   5                  END;
431   4                  CALL LD$TAB$HSKP (2);
432   4              END;

433   3          END;
434   2      END BUILD$LS$FRAME;

           /*************************************************************************
           PROCEDURE SERVICE$LOOP

           PURPOSE
                   TURNS A FRAME AROUND AT THE DATA LINK LAYER.  THE SOURCE AND
               DESTINATION ADDRESSES ARE SWITCHED AND THE FRAME PUT INTO THE DATA
               LINK LAYER TABLE.  AN APPROPRIATE SUPERVISORY FRAME IS SENT FOR
               RECEIVED FRAMES AND THE RECEIVED SUPERVISORY FRAMES ARE DUMPED.

           INTERFACE
                   CALLED BY XMIT$A AND XMIT$B.
           *************************************************************************/
435   1      SERVICE$LOOP: PROCEDURE(TABLE);
436   2          DECLARE CHANNEL BYTE,
                       ADDR(FRAME$SIZE) BYTE,
                       INP$SEQ$BIT BYTE,
                       TABLE   BYTE,
                       INDEX   INTEGER,
                       RETURN  INTEGER;

437   2          CHANNEL = 0;
```

```
376   3             DO;     /* IF CALLED TO BUILD S FRAME FOR CH A */
377   4                 CALL SENDSEQ(@TP$40, LENGTH(TP$40));
378   4                 ADDRESS$WORD = ROL(NT01RX (NT01NS), 4);
379   4                 IF INPUT$SEQ$BIT = TRUE THEN
380   4                     CONTROL$WORD = 0A0H;        /* CONT$WD = 10100000 */
381   4                 ELSE CONTROL$WORD = 080H;       /* CONT$WD = 10000000 */
382   4                 NT01TX (TX01NE+0) = ADDRESS$WORD;
383   4                 NT01TX (TX01NE+1) = CONTROL$WORD;
384   4                 DO INDEX = 2 TO (FRAME$SIZE - 1);
385   5                     NT01TX (TX01NE + INDEX) = '/';
386   5                 END;
387   4                 CALL LD$TAB$HSKP (3);
388   4             END;

389   3             DO;     /* IF CALLED TO BUILD S FRAME FOR CH B */
390   4                 CALL SENDSEQ(@TP$41, LENGTH(TP$41));
391   4                 ADDRESS$WORD = ROL(NT02RX (NT02NS), 4);
392   4                 IF INPUT$SEQ$BIT = TRUE THEN
393   4                     CONTROL$WORD = 0A0H;        /* CONT$WD = 10100000 */
394   4                 ELSE CONTROL$WORD = 080H;       /* CONT$WD = 10000000 */
395   4                 NT02TX (TX02NE+0) = ADDRESS$WORD;
396   4                 NT02TX (TX02NE+1) = CONTROL$WORD;
397   4                 DO INDEX = 2 TO (FRAME$SIZE - 1);
398   5                     NT02TX (TX02NE + INDEX) = '/';
399   5                 END;
400   4                 CALL LD$TAB$HSKP (4);
401   4             END;

402   3         END;
403   2     END BUILD$S$FRAME;

          /*************************************************************
          PROCEDURE BUILD$LOS$FRAME

          PURPOSE
              USED WITH SERVICE$LOOP TO TURN THE FRAME AROUND AT THE DATA LINK
              LAYER.

          INTERFACE
              CALLED BY SERVICE$LOOP
          *************************************************************/
404   1     BUILD$LOS$FRAME: PROCEDURE(TABLE, INPUT$SEQ$BIT) REENTRANT;
405   2         DECLARE TABLE WORD,
                      ADDRESS$WORD BYTE,
                      CONTROL$WORD BYTE,
                      INPUT$SEQ$BIT BYTE,
                      INDEX   INTEGER;

406   2         IF TABLE >= 1 AND TABLE <= 2 THEN
407   2         DO CASE TABLE;
```

```
                        PACKET$SIZE);
367   4                 CALL LO$TAB$HSNP (4);
368   4               END;
369   3           END;

370   2       END BUILD$I$FRAME;

              /*****************************************************************
              PROCEDURE   BUILD$S$FRAME        BUILD A SUPERVISORY FRAME

                  THE PURPOSE OF THIS PROCEDURE IS TO BUILD A SUPERVISORY FRAME AND PLACE
              IT INTO THE APPROPRIATE OUTGOING TABLE FOR TRANSMISSION TO THE NETWORK VIA
              EITHER NETWORK CHANNEL A OR CHANNEL B.

              INPUT
                  THIS PROCEDURE IS PASSED A TWO CHARACTER ASCII VALUE INDICATING THE
               LOCATION OF THE OUTGOING S FRAME AND THE SEQUENCE BIT OF THE INCOMING I
               FRAME (MODULO 2).

              PROCESSING
                  THE PROCESSING BEGINS WITH THE PASSING OF THE TABLE WHERE THE NEWLY
               CREATED S FRAME IS TO BE PLACED.  THE PROCEDURE THEN PERFORMS A SERIES OF
               LOGICAL OPERATIONS AND DIVISIONS TO SWAP THE HIGH 4 ORDER BITS OF THE
               ADDRESS WORD WITH THE LOWER ORDER BITS.  THIS SIMPLY INTERCHANGES THE
               DESTINATION AND SOURCE ADDRESSES.  IT THEN SETS THE CONTROL WORD ACCORDING
               TO THE SEQUENCE BIT OF THE INCOMING I FRAME.  THESE BYTES ARE THEN PLACED
               IN THE FIRST AND SECOND HEADER POSITIONS OF THE OUTGOING NETWORK TABLE.
               APPROPRIATE TABLE POINTERS ARE THEN UPDATED.

              OUTPUT
                  SEE PROCESSING ABOVE.

              INTERFACE
                  THIS PROCEDURE IS CALLED BY ROUTE$IN WHENEVER A NEW I FRAME ARRIVES.

              NOTES:  1.  THE X.25 AND LAP PROTOCOLS ALLOW FOR ADDITIONAL TYPES OF S
                   FRAMES WHICH MAY BE INCORPORATED DURING FURTHER DEVELOPMENT.
              *****************************************************************/
371   1       BUILD$S$FRAME: PROCEDURE(TABLE, INPUT$SEQ$BIT) REENTRANT;

372   2           DECLARE TABLE WORD,
                      ADDRESS$WORD BYTE,
                      CONTROL$WORD BYTE,
                      INPUT$SEQ$BIT BYTE,
                      INDEX   INTEGER;

373   2           IF TABLE >= 1 AND TABLE <= 2 THEN
374   2           DO CASE TABLE;

375   3               ;       /* ZERO IS NULL AND AN ERROR */
```

```
            NEWLY CREATED I FRAME IS TO BE PLACED.  THE DESTINATION ADDRESS IS READ
            FROM THE PACKET HEADER LOCATED IN TABLE LCNTTB AND PLACED INTO THE
            FRAME HEADER FIELD.  THE SOURCE ADDRESS IS THEN ADDED BY USING THE
            THIS$UNID$NBR VARIABLE.  THE CONTROL FIELD BYTE IS INITIALIZED TO ZERO
            AND WILL BE CHANGED BASED UPON LATER ACTION BY THE ROUTING PROCEDURE.

        OUTPUT      THIS PROCEDURE PLACES THE FIRST TWO BYTES INTO THE INDICATED
            OUTPUT TABLE BEFORE THE PACKET IS TRANSFERRED OVER TO THE CORRECT
            OUTPUT NETWORK TABLE.

        INTERFACE   THIS PROCEDURE IS CALLED FROM THE ROUTE$IN PROCEDURE FOR THOSE
            DATA PACKETS DESTINED FOR THE NETWORK ONLY.

        NOTES:      1.  THE HEADER INFORMATION IS BASED ON THE FIELDS DEFINED BY
            PHISTER'S TESTS ONLY.  EVEN THOUGH THEY CORRESPOND TO THE HDLC
            PROTOCOL, CAUTION SHOULD BE TAKEN BEFORE ADDING OR DELETING ADDITIONAL
            HEADERS.
            ************************************************************************/
343  1      BUILD$I$FRAME: PROCEDURE(TABLE) REENTRANT;
344  2          DECLARE TABLE WORD,
                    ADDRESS$BYTE BYTE,
                    CONTROL$BYTE BYTE;

345  2          ADDRESS$BYTE = (LCNTTB(LCNTNS + 0) AND 0FH) OR
                                (ROL(THIS$UNID$NBR, 4) AND 0F0H);

346  2          IF TABLE >= 1 AND TABLE <= 2 THEN
347  2          DO CASE TABLE;

348  3              ;   /* ZEROTH ENTRY IS NULL AND AN ERROR */

349  3              DO; /* I FRAME IS GOING OUT NETWORK CHANNEL A */
350  4                  CALL SENDSEQ(@TP$38, LENGTH(TP$38));
351  4                  NTO1TX (TX01NE+0) = ADDRESS$BYTE;
352  4                  IF SEQ$BIT$A = FALSE THEN
353  4                      CONTROL$BYTE = 0H;
354  4                  ELSE CONTROL$BYTE = 20H;
355  4                  NTO1TX (TX01NE+1) = CONTROL$BYTE;
356  4                  CALL MOVB( @LCNTTB (LCNTNS), @NTO1TX (TX01NE+2),
                            PACKET$SIZE);
357  4                  CALL LD$TAB$INSKP (3);
358  4              END;

359  3              DO; /* I FRAME IS GOING OUT NETWORK CHANNEL B */
360  4                  CALL SENDSEQ(@TP$39, LENGTH(TP$39));
361  4                  NTO2TX (TX02NE+0) = ADDRESS$BYTE;
362  4                  IF SEQ$BIT$B = FALSE THEN
363  4                      CONTROL$BYTE = 0H;
364  4                  ELSE CONTROL$BYTE = 20H;
365  4                  NTO2TX (TX02NE+1) = CONTROL$BYTE;
366  4                  CALL MOVB( @LCNTTB (LCNTNS), @NTO2TX (TX02NE+2),
```

```
312  4                IF NTO1NS >= NTO1SZ THEN        /* IF TABLE WRAP */
313  4                    NTO1NS = 0;
314  4            END;

315  3            DO; /* IF CALLED TO HSKP INCOMING NET CH B TABLE */
316  4                NTO2NS = NTO2NS + FRAME$SIZE;
317  4                IF NTO2NS >= NTO2SZ THEN        /* IF TABLE WRAP */
318  4                    NTO2NS = 0;
319  4            END;

320  3            DO; /* IF CALLED TO HSKP OUTGOING NET CH A TABLE */
321  4                TX01NS = TX01NS + FRAME$SIZE;
322  4                IF TX01NS >= TX01SZ THEN     /* IF TABLE WRAP */
323  4                    TX01NS = 0;
324  4            END;

325  3            DO; /* IF CALLED TO HSKP OUTGOING NET CH B TABLE */
326  4                TX02NS = TX02NS + FRAME$SIZE;
327  4                IF TX02NS >= TX02SZ THEN     /* IF TABLE WRAP */
328  4                    TX02NS = 0;
329  4            END;

330  3            DO; /* IF CALLED TO HSKP NETWORK TO LOCAL TABLE */
331  4                NTLCNS = NTLCNS + PACKET$SIZE;
332  4                IF NTLCNS >= NTLCSZ THEN
333  4                    NTLCNS = 0;
334  4            END;

335  3            DO; /* IF CALLED TO HOUSEKEEP LOCAL TO NET TABLE */
336  4                LCNTNS = LCNTNS + PACKET$SIZE;
337  4                IF LCNTNS >= LCNTSZ THEN        /* IF TABLE WRAP */
338  4                    LCNTNS = 0;
339  4            END;

340  3        END;
341  2        ELSE HSKP$ERR = HSKP$ERR + 1;
342  2    END SAVE$TAB$HSKP;
```

```
/*****************************************************************************
PROCEDURE BUILD$I$FRAME    TRANSFORM A PACKET INTO AN I FRAME.

     THE PURPOSE OF THIS PROCEDURE IS TO TRANSFORM A PACKET OF DATA
DELIVERED FROM THE LOCAL SIDE OF THE UNID INTO AN I FRAME TO BE PLACED INTO
ONE OF THE OUTGOING NET TABLES.  THIS PROCEDURE ADDS ON THE TWO HEADER
BYTES: ADDRESS BYTE AND CONTROL BYTE.

INPUT       THIS PROCEDURE RECEIVES A TWO CHARACTER ASCII VALUE INDICATING
     THE LOCATION OF THE OUTGOING NETWORK PORT WHERE THE NEWLY CREATED I
     FRAME IS TO BE PLACED.

PROCESSING     THE PROCESSING BEGINS WITH THE PASSING OF THE TABLE WHERE THE
```

```
269  4                  IF TX02NE >= TX02SZ THEN  /* IF TABLE WRAP */
290  4                      TX02NE = 0;
291  4              END;

292  3              DO;     /* HSKP NETWORK TO LOCAL TABLE */
293  4                  NTLONE = NTLONE + PACKET$SIZE;
294  4                  IF NTLONE >= NTLOSZ THEN    /* IF TABLE WRAP */
295  4                      NTLONE = 0;
296  4              END;

297  3              DO;     /* HSKP LOCAL TO NETWORK TABLE */
298  4                  LONTNE = LONTNE + PACKET$SIZE;
299  4                  IF LONTNE >= LONTSZ THEN    /* IF TABLE WRAP */
300  4                      LONTNE = 0;
301  4              END;

302  3          END;
303  2          ELSE HSKP$ERR = HSKP$ERR + 1;
304  2      END LD$TAB$HSKP;

           /*************************************************************************
           PROCEDURE   SRVC$TAB$HSKP       SERVICE TABLE HOUSEKEEP

               THE PURPOSE OF THIS PROCEDURE IS TO HOUSEKEEP A SPECIFIED TABLE AFTER
               SERVICING (REMOVING EITHER A PACKET OR FRAME).

           INPUT   THE INPUT IS AN INTEGER VALUE INDICATING THE TABLE REQUIRING
               HOUSEKEEPING.

           PROCESSING  THE PROCEDURE DETERMINES THE TABLE TO BE PROCESSED, ADVANCES
               THE NEXT BYTE TO BE SERVICED POINTER BY AA PACKET OR FRAME SIZE, AND
               ADJUSTS FOR TABLE WRAP IF NECESSARY.

           OUTPUT  THE SPECIFIED TABLE HAS ITS NEXT BYTE TO BE SERVICED POINTER
               ADVANCED BY THE LENGTH OF A PACKET OR FRAME.

           INTERFACE   THIS PROCEDURE IS CALLED BY PROCEDURE ROUTE$IN AND ROUTE$OUT.

           NOTES:      NONE.
           *************************************************************************/

305  1      SRVC$TAB$HSKP: PROCEDURE(TABLE) REENTRANT;
306  2          DECLARE TABLE BYTE;

307  2          IF TABLE >= 1 AND TABLE <= 6 THEN
308  2          DO CASE TABLE;

309  3              ;   /* ZEROTH ENTRY IS NULL AND AN ERROR */

310  3              DO; /* IF CALLED TO HSKP INCOMING NET CH A TABLE */
311  4                  NTOINS = NTOINS + FRAME$SIZE;
```

```
266  2      END DET$DEST$LN;
            /*************************************************************************
            PROCEDURE   LD$TAB$HSKP          LOAD TABLE HOUSEKEEPING

                THE PURPOSE OF THIS PROCEDURE IS TO HOUSEKEEP A SPECIFIED TABLE AFTER
                THE LOADING OF A PACKET OR A FRAME.

            INPUT       THE INPUT IS AN INTEGER VALUE INDICATING THE TABLE REQUIRING
                 HOUSEKEEPING.

            PROCESSING  THE PROCEDURE DETERMINES THE TABLE TO BE PROCESSED, ADVANCES
                THE NEXT EMPTY BYTE POINTER BY A PACKET OR FRAME SIZE, AND ADJUSTS
                FOR TABLE WRAP IF NECESSARY.

            OUTPUT      THE SPECIFIED TABLE HAS ITS NEXT EMPTY BYTE POINTER ADVANCED BY
                THE LENGTH OF A PACKET OR A FRAME.

            INTERFACE   THIS PROCEDURE IS CALLED BY PROCEDURE ROUTE$IN.

            NOTES       NONE.
            *************************************************************************/

267  1      LD$TAB$HSKP: PROCEDURE(TABLE) REENTRANT;

268  2          DECLARE TABLE   BYTE;

269  2          IF (TABLE >= 1 AND TABLE <= 6) THEN
270  2          DO CASE TABLE;

271  3              ;       /* ZERO CASE IS NULL AND IS AN ERROR CASE */

272  3              DO;      /* HSKP INCOMING NET CH A TABLE */
273  4                  NT01NE = NT01NE + FRAME$SIZE;
274  4                  IF NT01NE >= NT01SZ THEN   /* IF TABLE WRAP */
275  4                      NT01NE = 0;
276  4              END;

277  3              DO;      /* HSKP INCOMING NET CH B TABLE */
278  4                  NT02NE = NT02NE + FRAME$SIZE;
279  4                  IF NT02NE >= NT02SZ THEN    /* IF TABLE WRAP */
280  4                      NT02NE = 0;
281  4              END;

282  3              DO;     /* HSKP OUTGOING NET CH A TABLE */
283  4                  TX01NE = TX01NE + FRAME$SIZE;
284  4                  IF TX01NE >= TX01SZ THEN  /* IF TABLE WRAP */
285  4                      TX01NE = 0;
286  4              END;

287  3              DO;     /* HSKP OUTGOING NET CH B TABLE */
288  4                  TX02NE = TX02NE + FRAME$SIZE;
```

```
                        INTO THE NETWORK.

    THE PURPOSE OF THIS PROCEDURE IS TO DETERMINE THE OUTGOING NETWORK
    CHANNEL FOR THE PACKET LOCATED IN TABLE LCNTTB.

INPUT     < THE INPUT IS A TWO CHARACTER ASCII VALUE INDICATING THE TABLE
    REQUIRING EVALUATION. >

PROCESSING  THIS PROCEDURE CALCULATES THE NUMBER OF HOPS REQUIRED TO GO
    FROM THIS UNID TO THE DESTINATION UNID BOTH RIGHT AND LEFT.

OUTPUT      THIS PROCEDURE RETURNS 'CA' IF THE DISTANCE IS SHORTER GOING OUT
    THE RIGHT RING AND RETURNS 'CB' IF THE DISTANCE IS SHORTER GOING OUT
    THE LEFT RING.

INTERFACE   THIS PROCEDURE IS CALLED BY PROCEDURE ROUTE$IN.

NOTES   1.  THIS PROCEDURE IS A PRIMITIVE ROUTING ALGORITHM THAT JUST
            CALCULATES THE PATH DISTANCE BOTH RIGHT AND LEFT.
        2.  THIS PROCEDURE DOES NOT TAKE INTO ACCOUNT ANY FLOW CONTROL.
*************************************************************************/

242   1     DET$DEST$LN: PROCEDURE WORD REENTRANT;

243   2         DECLARE     DESTINATION$UNID    INTEGER,
                          DISTANCE$LEFT       INTEGER,
                          DISTANCE$RIGHT      INTEGER;

244   2         DESTINATION$UNID = INT(LCNTTB (LCNTNS) AND 0FH);
245   2         IF DESTINATION$UNID >= INT(THIS$UNID$NBR) THEN DO;
247   3             CALL SENDSEQ(@TP$34, LENGTH(TP$34));
248   3             DISTANCE$LEFT = DESTINATION$UNID - INT(THIS$UNID$NBR);
249   3             DISTANCE$RIGHT = INT(THIS$UNID$NBR) + (INT(MAX$NETWORK$CODE) -
                          DESTINATION$UNID + 1);
250   3             END;
251   2         ELSE DO;
252   3             CALL SENDSEQ(@TP$35, LENGTH(TP$35));
253   3             DISTANCE$LEFT = INT(THIS$UNID$NBR) +
                          (INT(MAX$NETWORK$CODE) - DESTINATION$UNID + 1);
254   3             DISTANCE$RIGHT = DESTINATION$UNID - INT(THIS$UNID$NBR);
255   3             END;
256   2         IF DISTANCE$LEFT >= DISTANCE$RIGHT THEN DO;
258   3             CALL SENDSEQ(@TP$36, LENGTH(TP$36));
259   3             DESTINATION = 'CA';
260   3             END;
261   2         ELSE DO;
262   3             CALL SENDSEQ(@TP$37, LENGTH(TP$37));
263   3             DESTINATION = 'CB';
264   3         END;
265   2         RETURN DESTINATION;
```

```
                PROCEDURE DET$DEST$TWO  DETERMINE DEST OF INCOMING FRAME FROM CHANNEL B
                    THE PURPOSE OF THIS PROCEDURE IS TO DETERMINE THE DESTINATION OF A
                SPECIFIED INCOMING FRAME COMING INTO CHANNEL A (B).

                INPUT       THE INPUT IS AN INTEGER VALUE INDICATING THE TABLE LOCATION
                     OF THE FRAME TO BE EVALUATED.

                PROCESSING  THIS PROCEDURE LOOKS AT THE FIRST BYTE OF THE NETWORK INPUT
                    TABLE (NTO1RX) SERVICING CH A AND DETERMINES IF THE DATA FRAME IS
                    DESTINED FOR THIS PARTICULAR UNID OR SOME OTHER UNID.  IF IT GOES TO
                    THIS UNID, THEN 'NL', IF TO SOME OTHER UNID, THEN 'NN'.

                OUTPUT      THE PROCEDURE OUTPUTS A TWO CHARACTER ASCII VALUE INDICATING THE
                        TABLE OR CHANNEL DESTINATION OF THE FRAME.

                INTERFACE   THIS PROCEDURE IS CALLED BY PROCEDURE ROUTE$IN FOR INPUT
                    FRAMES.

                NOTES   1.  FOR THIS PROCEDURE, S FRAMES DESTINED FOR THIS UNID ARE 'NL'.
                ************************************************************************/

218   1         DET$DEST$ONE: PROCEDURE WORD REENTRANT;

219   2             IF (NTO1RX (NTO1NS) AND 0FH) = THIS$UNID$NBR THEN DO;
221   3                 CALL SENDSEQ(@TP$30, LENGTH(TP$30));
222   3                 DESTINATION = 'NL';
223   3                 END;
224   2             ELSE DO;
225   3                 CALL SENDSEQ(@TP$31, LENGTH(TP$31));
226   3                 DESTINATION = 'NN';
227   3             END;

228   2             RETURN DESTINATION;
229   2         END DET$DEST$ONE;

230   1         DET$DEST$TWO: PROCEDURE WORD REENTRANT;

231   2             IF (NTO2RX (NTO2NS) AND 0FH) = THIS$UNID$NBR THEN DO;
233   3                 CALL SENDSEQ(@TP$32, LENGTH(TP$32));
234   3                 DESTINATION = 'NL';
235   3                 END;
236   2             ELSE DO;
237   3                 CALL SENDSEQ(@TP$33, LENGTH(TP$33));
238   3                 DESTINATION = 'NN';
239   3             END;

240   2             RETURN DESTINATION;
241   2         END DET$DEST$TWO;

                /************************************************************************
                PROCEDURE   DET$DEST$LN     DETERMINES DESTINATION OF AN OUTGOING PACKET
```

```
                THE PURPOSE OF THIS PROCEDURE IS TO PRODUCE A TIME DELAY TO BE USED BETWEEN
                     SUCCESSIVE TRANSMISSIONS OF I FRAMES OUT OF CH A WHEN A VALID
                     ACKNOWLEDGEMENT HAS NOT BEEN RECEIVED.

                INPUT       NONE.

                PROCESSING - THE PROCEDURE BEGINS BY CALLING THE (ASSEMBLY) ROUTINE STCTCB
                     WHICH INITIALIZES AND STARTS THE CTC CHANNEL #x. EACH TIME THE CTC RUNS
                     OUT, ITS INTERRUPT ROUTINE (TOUTCA) INCREMENTS THE GLOBAL VARIABLE
                     'CTCNOA'.  WHENEVER THE CTCNOA VALUE IS GREATER OR EQUAL TO THE GLOBAL
                     VARIABLE 'MAXNOA', THE GLOBAL VARIABLE 'TIMCHA' IS CHANGED TO TRUE.

                OUTPUT - THE OUTPUT IS THE VARIABLE 'TIMCHA'.  WHEN TRUE THE TIME DELAY
                     SEQUENCE IS COMPLETE.

                INTERFACE - THIS PROCEDURE IS CALLED BY THE PROCEDURE ROUTE$OUT LOCATED
                     WITHIN THIS SAME MODULE.  THIS PROCEDURE CALLS PROCEDURE STCTCA WHICH
                     IS LOCATED IN THIS PROGRAM.

                NOTES:  1.  SEE PROCEDURE STCTCA FOR AN EXAMPLE OF CALCULATING THE
                              APPROPRIATE TIME DELAY.
                        2.  VARIABLES TOUTCA, CTCNOA, AND MAXNOA ALLOW CHANNEL A TO BE
                              INDEPENDENT OF CHANNEL B WHEN CONSIDERING TIME DELAY TO AN
                              ADJACENT UNID.
                ************************************************************************/
198   1         TIME$DELAY$CHA: PROCEDURE REENTRANT;

199   2             IF TIMCHA = TRUE THEN
200   2                 CALL STCTCA;     /* IF TIMER IS NOT RUNNING, THEN START IT */
                    ELSE
201   2                 CTCNOA = CTCNOA + 1;
202   2             IF CTCNOA >= MAXNOA THEN DO;
204   3                 TIMCHA = TRUE;
205   3                 CTCNOA = 0;
206   3             END;
207   2         END TIME$DELAY$CHA;

208   1         TIME$DELAY$CHB: PROCEDURE REENTRANT;

209   2             IF TIMCHB = TRUE THEN
210   2                 CALL STCTCB;     /* IF TIMER IS NOT RUNNING, THEN START IT */
                    ELSE
211   2                 CTCNOB = CTCNOB + 1;
212   2             IF CTCNOB >= MAXNOB THEN DO;
214   3                 TIMCHB = TRUE;
                        CTCNOB = 0;
216   3             END;
217   2         END TIME$DELAY$CHB;

                /************************************************************************
                PROCEDURE DET$DEST$ONE  DETERMINE DEST OF INCOMING FRAME FROM CHANNEL A.
```

```
177   2       END ASC$HEX;

178   1       VALID$HEX: PROCEDURE (H) BYTE;

179   2           DECLARE (H, I) BYTE;

180   2           DO I = 0 TO LAST(ASCII);
181   3               IF H = ASCII(I) THEN
182   3                   RETURN TRUE;
183   3           END;
184   2           RETURN FALSE;

185   2       END VALID$HEX;

                /*****************************************************************
                PROCEDURE SENDSEQ       SENDS DATA TO LOCAL MONITOR FOR TESTING

                    THIS PROCEDURE TAKES A MESSAGE STRING AND OUTPUTS IT TO THE
                SYSTEM CONSOLE.
                *****************************************************************/

186   1       SENDSEQ: PROCEDURE (MSG, TOTAL);
187   2           DECLARE MSG POINTER;
188   2           DECLARE TOTAL WORD;

189   2           CALL DQ$WRITE (W$CONN, MSG, TOTAL, @STATUS);
190   2           CALL ERR$CHK;

191   2       END SENDSEQ;

                /*****************************************************************
                    DUMMY PROCEDURES FOR ACTIVATING THE HARDWARE AND SOFTWARE TIMERS
                USED IN THE TIME$DELAY$CHA AND TIME$DELAY$CHB PROCEDURES.
                *****************************************************************/

192   1       STCTCA: PROCEDURE;

193   2           TIMCHA = FALSE;

194   2       END STCTCA;

195   1       STCTCB: PROCEDURE;

196   2           TIMCHB = FALSE;

197   2       END STCTCB;

                /*****************************************************************
                PROCEDURE   TIME$DELAY$CHA      PRODUCES A DELAY OF TIME FOR CHANNEL A
                            TIME$DELAY$CHB      PRODUCES A DELAY OF TIME FOR CHANNEL B
```

```
145   2          NTO1NE = 0;
146   2          NTO1SZ = FRAME$TABLE$SIZE;

147   2          NTO2NS = 0;
148   2          NTO2NE = 0;
149   2          NTO2SZ = FRAME$TABLE$SIZE;

150   2          TX01NS = 0;
151   2          TX01NE = 0;
152   2          TX01SZ = FRAME$TABLE$SIZE;

153   2          TX02NS = 0;
154   2          TX02NE = 0;
155   2          TX02SZ = FRAME$TABLE$SIZE;

156   2          LCNTNS = 0;
157   2          LCNTNE = 0;
158   2          LCNTSZ = PACKET$TABLE$SIZE;

159   2          NTLCNS = 0;
160   2          NTLCNE = 0;
161   2          NTLCSZ = PACKET$TABLE$SIZE;

162   2      END INIT$N$TAB;

              /*****************************************************************
              PROCEDURES TO CONVERT HEX TO ASCII FOR USE WITH DISPLAYING A FRAME
              *****************************************************************/

163   1      HEX$ASC: PROCEDURE(B) WORD;
164   2          DECLARE B BYTE;
165   2          DECLARE W WORD;

166   2          W = ASCII(SHR(B,4) AND 0FH);
167   2          W = ROL(W,8) AND 0FF00H;
168   2          W = W OR ASCII(B AND 0FH);
169   2          W = ROL(W,8);

170   2          RETURN W;

171   2      END HEX$ASC;

172   1      ASC$HEX: PROCEDURE(C) WORD;

173   2          DECLARE C BYTE;

174   2          IF C <= '9' THEN
175   2              RETURN DOUBLE(C-30H);
              ELSE
176   2              RETURN DOUBLE(C-37H);
```

```
115  1      DECLARE     TP$59(*) BYTE DATA(CR,LF,
            'TP$59          ACK B = TRUE');

116  1      DECLARE     MSG1(*) BYTE DATA(CR,LF,
            'Do you want to load the test message? ');
117  1      DECLARE     MSG2(*) BYTE DATA(CR,LF,
            'Do you want to stop the test? ');
118  1      DECLARE     MSG3(*) BYTE DATA(CR,LF,
            'How many packets to load (1-9)? ');
119  1      DECLARE     MSG4(*) BYTE DATA(CR,LF,
            'Send to which UNIO (1 or 3)? ');

            /*************************************************************************/

120  1      ERR$CHK: PROCEDURE PUBLIC;
121  2          IF STATUS <> 0 THEN         /* <> 0 IS AN ERROR */
122  2              DO;
123  3                  CALL DQ$DECODE$EXCEPTION ( STATUS, @STATUS$PTR, @STATUS);
124  3                  CALL DQ$WRITE (W$CONN, @STATUS$PTR(1), STATUS$PTR(0), @STATUS);
125  3                  CALL DQ$WRITE (W$CONN, @CRLF, 2, @STATUS);
126  3                  CALL DQ$EXIT (0);
127  3              END;
128  2      END ERR$CHK;

            /*************************************************************************/
129  1      INIT$N$TAB: PROCEDURE;

                /* VARIABLES FOR NETWORK CHANNEL A */
130  2          SEQ$BIT$A = FALSE;        /* MOD 2 SEQUENCE BIT */

                /* VARIABLES FOR NETWORK CHANNEL B */
131  2          SEQ$BIT$B = FALSE;        /* MOD 2 SEQUENCE BIT */

                /* VARIABLES FOR BOTH NETWORK CHANNELS */
132  2          INPUT$SEQ$BIT$A = FALSE;          /* SEQ BIT GOING INTO FRAME */
133  2          INPUT$SEQ$BIT$B = FALSE;          /* SEQ BIT GOING INTO FRAME */
134  2          THIS$SEQ$BIT$A  = FALSE;          /* CURRENT SEQUENCE BIT  */
135  2          THIS$SEQ$BIT$B  = FALSE;          /* CURRENT SEQUENCE BIT  */

136  2          TIMCHA = TRUE;            /* FLAG FOR CH A WAIT LOOP */
137  2          TIMCHB = TRUE;            /* FLAG FOR CH B WAIT LOOP */
138  2          CTONOA = 0;
139  2          CTONOB = 0;

140  2          FOREVER = TRUE;         /* FLAG FOR MAIN LOOP */
141  2          MSGNUM = 0;

142  2          RETRANS$A = 0;
143  2          RETRANS$B = 0;

144  2          NTOINS = 0;
```

```
                    'TP$36          DESTINATION IS CHANNEL A');
 91    1            DECLARE         TP$37(*) BYTE DATA(CR,LF,
                    'TP$37          DESTINATION IS CHANNEL B');
 92    1            DECLARE         TP$38(*) BYTE DATA(CR,LF,
                    'TP$38          BUILDING I FRAME FOR CHANNEL A');
 93    1            DECLARE         TP$39(*) BYTE DATA(CR,LF,
                    'TP$39          BUILDING I FRAME FOR CHANNEL B');
 94    1            DECLARE         TP$40(*) BYTE DATA(CR,LF,
                    'TP$40          BUILDING S FRAME FOR CHANNEL A');
 95    1            DECLARE         TP$41(*) BYTE DATA(CR,LF,
                    'TP$41          BUILDING S FRAME FOR CHANNEL B');
 96    1            DECLARE         TP$42(*) BYTE DATA(CR,LF,
                    'TP$42          ENTERING ROUTE$OUT PROCEDURE');
 97    1            DECLARE         TP$43(*) BYTE DATA(CR,LF,
                    'TP$43          END OF ROUTE$IN - ROUTE$OUT LOOP');
 98    1            DECLARE         TP$44(*) BYTE DATA(CR,LF,
                    'TP$44          HAVE EXITED ROUTE$IN - ROUTE$OUT LOOP',CR,LF);
 99    1            DECLARE         TP$45(*) BYTE DATA(CR,LF,
                    'TP$45          DATA IS NT01RX TO NTLCTB TRANSFER');
100    1            DECLARE         TP$46(*) BYTE DATA(CR,LF,
                    'TP$46          DATA IS NT02RX TO NTLCTB TRANSFER');
101    1            DECLARE         TP$47(*) BYTE DATA(CR,LF,
                    'TP$47          ERROR: UNID DESIGNATION > MAX$NETWORK$CODE');
102    1            DECLARE         TP$48(*) BYTE DATA(CR,LF,
                    'TP$48          ERROR: UNID DESIGNATION > MAX$NETWORK$CODE');
103    1            DECLARE         TP$49(*) BYTE DATA(CR,LF,
                    'TP$49          INPUT SEQ$BIT$A = 1');
104    1            DECLARE         TP$50(*) BYTE DATA(CR,LF,
                    'TP$50          INPUT SEQ$BIT$A = 0');
105    1            DECLARE         TP$51(*) BYTE DATA(CR,LF,
                    'TP$51          INPUT SEQ$BIT$B = 1');
106    1            DECLARE         TP$52(*) BYTE DATA(CR,LF,
                    'TP$52          INPUT SEQ$BIT$B = 0');

107    1            DECLARE         TP$53A(*) BYTE DATA(CR,LF,
                    'TP$53A         GENERATING I FRAME BACK TO SENDER');
108    1            DECLARE         TP$53B(*) BYTE DATA(CR,LF,
                    'TP$53B         S FRAME IN NETWORK AND DISCARDED');
109    1            DECLARE         TP$53C(*) BYTE DATA(CR,LF,
                    'TP$53C         GENERATING S FRAME BACK TO SENDER');
110    1            DECLARE         TP$54(*) BYTE DATA(CR,LF,
                    'TP$54          LOADED TEST PACKET IN LCNTTB');
111    1            DECLARE         TP$55(*) BYTE DATA(CR,LF,
                    'TP$55          READING NTLCTB PACKET TO CONOUT');
112    1            DECLARE         TP$56(*) BYTE DATA(CR,LF,
                    'TP$56          RETRANS$A >= 10; DUMPED FRAME');
113    1            DECLARE         TP$57(*) BYTE DATA(CR,LF,
                    'TP$57          RETRANS$B >= 10; DUMPED FRAME');

114    1            DECLARE         TP$58(*) BYTE DATA(CR,LF,
                    'TP$58          ACK A = TRUE');
```

```
438  2          DO CASE TABLE;

439  3              ;       /* ZERO IS NULL CASE */

440  3          DO;
441  4          IF ((TX01NE - TX01NS) >= FRAME$SIZE) OR
                       (TX01NS > TX01NE) THEN DO;

443  5              DO INDEX = 0 TO (FRAME$SIZE - 1);
444  6                  ADDR(INDEX) = NT01TX(TX01NS + INDEX);
445  6              END;
446  5              IF (ADDR(ORIGIN + 1) AND 80H) = 80H THEN DO;
                                                    /* DUMP THE ACK FRAME */
448  6                  CALL SENDSEQ(@TP$53B, LENGTH(TP$53B));
449  6                  END;
450  5              ELSE DO;
451  6                  IF (ADDR(ORIGIN + 1) AND 20H) = 20H THEN  /* SET THE SEQ BIT */
452  6                      INP$SEQ$BIT = TRUE;
453  6                  ELSE INP$SEQ$BIT = FALSE;
454  6                  CALL BUILD$LES$FRAME(1, INP$SEQ$BIT);
455  6                  CALL SENDSEQ(@TP$53C, LENGTH(TP$53C));
456  6                  CALL SENDSEQ(@TP$53A, LENGTH(TP$53A));
457  6                  NT01RX(NT01NE) = ROL(ADDR(ORIGIN), 4); /* SWAP FRAME HEADER */
458  6                  NT01RX(NT01NE + 1) = ADDR(ORIGIN + 1);
459  6                  NT01RX(NT01NE + 2) = ADDR(ORIGIN + 3); /* SWAP PACKET HEADER */
460  6                  NT01RX(NT01NE + 3) = ADDR(ORIGIN + 2);
461  6                  DO INDEX = 4 TO (FRAME$SIZE - 1);           /* SWAP DATA */
462  7                      NT01RX(NT01NE + INDEX) = ADDR(ORIGIN + INDEX);
463  7                  END;
464  6                  DO INDEX = 0 TO 3;                  /* SWAP IP DEST & SOURCE */
465  7                      NT01RX(NT01NE + INDEX + 19) = ADDR(ORIGIN + INDEX + 23);
466  7                      NT01RX(NT01NE + INDEX + 23) = ADDR(ORIGIN + INDEX + 19);
467  7                  END;
468  6                  CALL LD$TAB$HSKP( 1 );
469  6              END;
470  5          END;
471  4          END;        /* CASE = 1 */

472  3          DO;
473  4          IF ((TX02NE - TX02NS) >= FRAME$SIZE) OR
                       (TX02NS > TX02NE) THEN DO;

475  5              DO INDEX = 0 TO (FRAME$SIZE - 1);
476  6                  ADDR(INDEX) = NT02TX(TX02NS + INDEX);
477  6              END;
478  5              IF (ADDR(ORIGIN + 1) AND 80H) = 80H THEN DO;
                                                    /* DUMP THE ACK FRAME */
480  6                  CALL SENDSEQ(@TP$53B, LENGTH(TP$53B));
481  6                  END;
482  5              ELSE DO;
```

```
493  6                IF (ADDR(ORIGIN + 1) AND 20H) = 20H THEN  /* SET THE SEQ BIT */
494  6                    INP$SEQ$BIT = TRUE;
495  6                ELSE INP$SEQ$BIT = FALSE;
496  6                CALL BUILD$LS$FRAME(2, INP$SEQ$BIT);
497  6                CALL SENDSEQ(@TP$53C, LENGTH(TP$53C));
498  6                CALL SENDSEQ(@TP$53A, LENGTH(TP$53A));
499  6                NTO2RX(NTO2NE) = ROL(ADDR(ORIGIN), 4); /* SWAP FRAME HEADER */
500  6                NTO2RX(NTO2NE + 1) = ADDR(ORIGIN + 1);
501  6                NTO2RX(NTO2NE + 2) = ADDR(ORIGIN + 3); /* SWAP PACKET HEADER */
502  6                NTO2RX(NTO2NE + 3) = ADDR(ORIGIN + 2);
503  6                DO INDEX = 4 TO (FRAME$SIZE - 1);      /* SWAP DATA */
504  7                    NTO2RX(NTO2NE + INDEX) = ADDR(ORIGIN + INDEX);
505  7                END;
506  6                DO INDEX = 0 TO 3;                /* SWAP IP DEST & SOURCE */
507  7                    NTO2RX(NTO2NE + INDEX + 19) = ADDR(ORIGIN + INDEX + 23);
508  7                    NTO2RX(NTO2NE + INDEX + 23) = ADDR(ORIGIN + INDEX + 19);
509  7                END;
510  6                CALL LD$TAB$HDSP( 2 );
511  6            END;
512  5        END;
513  4        END;        /* CASE = 2 */

514  3        END;        /* CASE TABLE */

515  2    END SERVICE$LOOP;

516  1    SERVICE$XMIT$A: PROCEDURE;

517  2        CALL SERVICE$LOOP(1);

518  2    END SERVICE$XMIT$A;

519  1    SERVICE$XMIT$B: PROCEDURE;

520  2        CALL SERVICE$LOOP(2);

521  2    END SERVICE$XMIT$B;

         /*****************************************************************
         PROCEDURE LOAD AND READ$TAB

             THESE PROCEDURES ARE USED TO PUT A MESSAGE INTO THE CONTEB TABLE AND
             WRITE TO THE CRT A MESSAGE IN THE MTLOOP TABLE.
         *****************************************************************/
512  1    LOAD: PROCEDURE(DEST$UNID);

513  2        DECLARE INDEX INTEGER;
514  2        DECLARE DEST$UNID  WORD;

515  2            DO INDEX = 0 TO (PACKET$SIZE - 1);
516  3                CONTEB(CONTENE + INDEX) = '*';
```

```
517   3             END;
                 /* PACKET HEADER */
518   2             CNTTB(CONTNE) = (LOW(DEST$UNID) AND 0FH) OR 10H;
                                                 /* DEST = 1, CH = 1 */
519   2             CNTTB(CONTNE + 1) = (THIS$UNID$NBR AND 0FH) OR 10H;
                                                 /* SORC = 3, CH = 1 */
                 /* IP SOURCE HEADER */
520   2             CNTTB(CONTNE + 19) = 10H;       /* CT    = 0, CC    = 1 */
521   2             CNTTB(CONTNE + 20) = (THIS$UNID$NBR AND 0FH) OR 60H;
                                                 /* NC    = 3, HC(L) = 6 */
522   2             CNTTB(CONTNE + 21) = 70H;       /* HC(H) = 0, PC(0) = 7 */
523   2             CNTTB(CONTNE + 22) = 00H;       /* PC(1) = 0, PC(2) = 0 */

                 /* IP DESTINATION HEADER */
524   2             CNTTB(CONTNE + 23) = 10H;       /* CT    = 0, CC    = 1 */
525   2             CNTTB(CONTNE + 24) = (LOW(DEST$UNID) AND 0FH) OR 60H;
                                                 /* NC    = 1, HC(L) = 6 */
526   2             CNTTB(CONTNE + 25) = 70H;       /* HC(H) = 0, PC(0) = 7 */
527   2             CNTTB(CONTNE + 26) = 00H;       /* PC(1) = 0, PC(2) = 0 */

528   2             CALL MOVB(@MESSAGE, @CNTTB(CONTNE + 61), TCP$DATA$SIZE);
529   2             IF MSGNUM > 9 THEN
530   2                 MSGNUM = 0;
531   2             CNTTB(CONTNE + 91) = '0' + MSGNUM;
532   2             MSGNUM = MSGNUM + 1;
533   2             CALL LD$TAB$HSKP(5);
534   2             CALL SENDSEQ(@TP$54, LENGTH(TP$54));

535   2       END LOAD;

536   1       READ$TAB:   PROCEDURE;

537   2             IF ((NTLCNE - NTLCNS) >= PACKET$SIZE) OR (NTLCNS > NTLCNE) THEN DO;
538   3                 CALL SENDSEQ(@TP$55, LENGTH(TP$55));
539   3                 CALL SENDSEQ(@NTLCTB(NTLCNS + 61), TCP$DATA$SIZE);
540   3                 CALL SRVC$TA3$HSKP(5);
541   3             END;

542   2       END READ$TAB;

                /*****************************************************************
                PROCEDURE  FIND$1FRAME FINDS THE FIRST 1 FRAME IN THE NT01TX, NT02TX TABLES

                    THE PURPOSE OF THIS PROCEDURE IS TO FIND THE FIRST 1 FRAME IN THE
                NT01TX, NT02TX     TABLES AND RETURN A TRUE BOOLEAN VALUE IF THERE
                IS AN 1 FRAME IN THE SELECTED TABLE.
                *****************************************************************/
543   1       FIND$1FRAME:    PROCEDURE(TABLE) BYTE;

544   2           DECLARE (TABLE,
                         FRAME$THERE,
```

```
                        HAVE$IFRAME) BYTE;
546   2           DECLARE INDEX   INTEGER;

547   2           FRAME$THERE = TRUE;
548   2           HAVE$IFRAME = FALSE;
549   2           INDEX = 0;

550   2           DO CASE TABLE;

551   3               ;       /* ZERO IS NULL */

552   3               DO;
553   4               DO WHILE FRAME$THERE;

554   5               IF ((TX01NE - TX01NS - INDEX) >= FRAME$SIZE) OR
                            ((TX01NS + INDEX) > TX01NE) THEN DO;
556   6                   IF (NT01TX(TX01NS + INDEX + 1) AND 80H) = 0H
                            THEN DO;        /* HAVE AN INFORMATION FRAME */
558   7                       HAVE$IFRAME = TRUE;
559   7                       FRAME$THERE = FALSE;
560   7                       END;
                        ELSE
561   6                       HAVE$IFRAME = FALSE;    /* HAVE AN S FRAME */
562   6                   END;
563   5               ELSE DO;
564   6                   HAVE$IFRAME = FALSE;
565   6                   FRAME$THERE = FALSE;
566   6               END;

567   5               INDEX = INDEX + FRAME$SIZE;
568   5               END;        /* DO WHILE FRAME$THERE */
569   4               END;    /* CASE TABLE = 1 */

570   3               DO;
571   4               DO WHILE FRAME$THERE;

572   5               IF ((TX02NE - TX02NS - INDEX) >= FRAME$SIZE) OR
                            ((TX02NS + INDEX) > TX02NE) THEN DO;
574   6                   IF (NT02TX(TX02NS + INDEX + 1) AND 80H) = 0H
                            THEN DO;        /* HAVE AN INFORMATION FRAME */
576   7                       HAVE$IFRAME = TRUE;
577   7                       FRAME$THERE = FALSE;
578   7                       END;
                        ELSE
579   6                       HAVE$IFRAME = FALSE;    /* HAVE AN S FRAME */
580   6                   END;
581   5               ELSE DO;
582   6                   HAVE$IFRAME = FALSE;
583   6                   FRAME$THERE = FALSE;
584   6               END;
```

```
585   5             INDEX = INDEX + FRAME$SIZE;
586   5             END;        /* DO WHILE FRAME$THERE */
587   4             END;    /* CASE TABLE = 2 */

588   3         END;        /* CASE TABLE */
589   2         RETURN HAVE$IFRAME;

590   2     END FIND$IFRAME;

          /*************************************************************************
          PROCEDURE:  SERVICE     RESETS TRANSMIT I FRAME FLAGS AND COUNTERS

              THE PURPOSE OF THIS PROCEDURE IS TO RESET THE TRANSMIT I FRAME
            FLAGS AND COUNTERS AND CALL THE APPROPRIATE SRVC$TAB$HSKP ROUTINE.
          *************************************************************************/
591   1     INIT$ACK:   PROCEDURE(TABLE);

592   2         DECLARE TABLE BYTE;

593   2         IF (TABLE >= 3) AND (TABLE <= 4) THEN DO;
594   3             CALL SRVC$TAB$HSKP(TABLE);
595   3             DO CASE TABLE;

597   4                 ;       /* ZEROTH ENTRY IS NULL AND AN ERROR */

598   4                 ;       /* FIRST  ENTRY IS NULL AND AN ERROR */

599   4                 ;       /* SECOND ENTRY IS NULL AND AN ERROR */

600   4                 DO;
601   5                     TIMCHA = TRUE;
602   5                     CTCNOA = 0;
603   5                     RETRANS$A = 0;
604   5                 END;

605   4                 DO;
606   5                     TIMCHB = TRUE;
607   5                     CTCNOB = 0;
608   5                     RETRANS$B = 0;
609   5                 END;
610   4             END;        /* END CASE */
611   3         END;            /* END IF   */

612   2     END INIT$ACK;

          /*************************************************************************
          PROCEDURE:  ROUTE$III    ROUTES PACKETS TO FROM EITHER CHAN A OR CHAN B

              THE PURPOSE OF THIS PROCEDURE IS TO ROUTE PACKETS FROM THE NETWORK
          INPUT TABLES TO THEIR CORRECT OUTPUT TABLE.  IT INITIATES THE BUILDING OF AN
          S FRAME FOR ACKNOWLEDGEMENT OF GOOD I FRAMES.  IT ALSO INSURES THE PROPER
```

```
        SEQUENCING OF FRAMES BY THE USE OF MODULO 2 NUMBERING SCHEME.

        INPUT
            DATA PACKETS OR FRAMES ARE ROUTED VIA EVALUATION OF NTO1RX AND NTO2RX
        POINTERS AND FRAME HEADER ROUTING INFORMATION.

        PROCESSING
            THE PROCEDURE CHECKS NTO1RX AND NTO2RX POINTERS FOR FRAME ARRIVAL.  IT
        THEN DETERMINES IF THE FRAME IS DESTINED FOR THIS UNID OR ANOTHER UNID.  IF
        FOR ANOTHER UNID, THE PROCEDURE SIMPLY ROUTES IT BACK TO THE NETWORK.  IF
        THE INCOMING FRAME WAS ON CHAN A, THEN IT IS SUBSEQUENTLY TRANSMITTED OUT
        CHAN B.  IF THE INCOMING FRAME WAS ON CHAN B, THEN IT IS ROUTED OUT CHAN A.
        THIS WILL CREATE A DUAL RING ON THE NETWORK SIDE OF THE UNIDS.  ONE
        DIRECTION THE FRAMES MOVE CLOCKWISE AND THE OTHER COUNTER CLOCKWISE.
            IF THE INCOMING FRAME IS DESTINED FOR THIS PARTICULAR UNID, THEN IT
        DETERMINES THE TYPE OF FRAME.  IF IT IS AN I FRAME, THEN IT CALLS THE
        BUILD$S$FRAME PROCEDURE TO PROVIDE A POSITIVE ACKNOWLEDGEMENT AND THEN MOVES
        THE FRAME TO THE NETWORK TO LOCAL TABLE MINUS THE FRAME HEADER.  IF IT IS AN
        S FRAME, THEN IT TESTS TO SEE IF IT IS AN ACKNOWLEDGEMENT FOR ITS LAST
        TRANSMITTED I FRAME.  THIS PROCEDURE USES PROCEDURE DET$DEST$ONE AND
        DET$DEST$TWO TO DETERMINE DESTINATION AND THE MOVB PROCEDURE TO MOVE THE
        FRAME BETWEEN TABLES.

        OUTPUT
            THIS PROCEDURE PRODUCES TWO OUTPUTS.  THE FIRST IS A FRAME FROM THE
        NETWORK SIDE DESTINED FOR ONE OF THE OUTGOING LOCAL CHANNELS.  THE SECOND
        OUTPUT IS A FRAME FROM THE NETWORK DESTINED FOR ANOTHER UNID LOCATED ON THE
        NETWORK.

        INTERFACE
            THIS PROCEDURE IS CALLED IN AN ENDLESS LOOP BY PROCEDURE MAIN.

        NOTES:  NONE.
        ************************************************************************/
613  1  ROUTE$IN: PROCEDURE REENTRANT;

614  2      IF ((NTO1NE - NTO1NS) >= FRAME$SIZE) OR (NTO1NS > NTO1NE) THEN DO;
                                    /* SERVICE CHAN A */
616  3          CALL SENDSEQ(@TP$5, LENGTH(TP$5));
617  3          IF (NTO1RX (NTO1NS+1) AND 080H) = 080H THEN DO;
                                /* HAVE AN S FRAME */
619  4              CALL SENDSEQ(@TP$8, LENGTH(TP$8));
620  4              IF (NTO1RX (NTO1NS+1) AND 020H) = 020H THEN DO;
                            /* CHECKS SEQUENCE BIT */
622  5                  CALL SENDSEQ(@TP$9, LENGTH(TP$9));
623  5                  THIS$SEQ$BIT$A = TRUE;
624  5                  IF THIS$SEQ$BIT$A = SEQ$BIT$A THEN DO;
626  6                      SEQ$BIT$A = NOT SEQ$BIT$A;
627  6                      CALL INITACK(3);
628  6                      CALL SENDSEQ(@TP$58, LENGTH(TP$58));
629  6                  END;
```

```
630   5                 END;
631   4               ELSE DO;
632   5                 CALL SENDSEQ(@TP$10, LENGTH(TP$10));
633   5                 THIS$SEQ$BIT$A = FALSE;
634   5                 IF THIS$SEQ$BIT$A = SEQ$BIT$A THEN DO;
636   6                   SEQ$BIT$A = NOT SEQ$BIT$A;
637   6                   CALL INITACK(3);
638   6                   CALL SENDSEQ(@TP$58, LENGTH(TP$58));
639   6                 END;
640   5                 END;    /* END IF XX = 20H */
641   4               END;        /* END IF XX = 80H */

642   3             ELSE DO;            /* HAVE AN I FRAME */

643   4               CALL SENDSEQ(@TP$11, LENGTH(TP$11));
644   4               DESTINATION = DET$DEST$ONE;
645   4               IF DESTINATION ='NN' THEN DO;
                                  /* FRAME DESTINED FOR ANOTHER UNID */
647   5                 IF (NTO1RX (NTO1NS+1) AND 020H) = 020H THEN DO;
649   6                   CALL SENDSEQ(@TP$49, LENGTH(TP$49));
650   6                   INPUT$SEQ$BIT$A = TRUE;       /* SEQ$BIT$A = 1 */
651   6                   END;
652   5                 ELSE DO;
653   6                   CALL SENDSEQ(@TP$50, LENGTH(TP$50));
654   6                   INPUT$SEQ$BIT$A = FALSE;          /* SEQ$BIT$A = 0 */
655   6                 END;
656   5                 CALL BUILD$S$FRAME(1, INPUT$SEQ$BIT$A);
657   5                 CALL SENDSEQ(@TP$6, LENGTH(TP$6));
658   5                 CALL MOVB( @NTO1RX (NTO1NS), @NTO2TX (TXO2NE),
                            FRAME$SIZE);
659   5                 CALL LD$TAB$HSKP (4);
660   5               END;    /* IF DEST = 'NN' */

661   4               IF DESTINATION = 'NL' THEN DO;
                                    /* FRAME DESTINED FOR THIS UNID */
663   5                 CALL SENDSEQ(@TP$7, LENGTH(TP$7));
664   5                 IF (NTO1RX (NTO1NS+1) AND 020H) = 020H THEN DO;
666   6                   CALL SENDSEQ(@TP$12, LENGTH(TP$12));
667   6                   INPUT$SEQ$BIT$A = TRUE;
668   6                   END;
669   5                 ELSE DO;
670   6                   CALL SENDSEQ(@TP$13, LENGTH(TP$13));
671   6                   INPUT$SEQ$BIT$A = FALSE;
672   6                 END;
673   5                 CALL BUILD$S$FRAME (1, INPUT$SEQ$BIT$A);
674   5                 CALL SENDSEQ(@TP$45, LENGTH(TP$45));
675   5                 CALL MOVB( @NTO1RX (NTO1NS+2), @NTLOTB (NTLONE),
                                                    PACKET$SIZE);
676   5                 CALL LD$TAB$HSKP (5);   /* HSKP 'NL' */
677   5               END;        /* END OF DEST = 'NL' CONDITION */
678   4             END;          /* END OF I FRAME */
```

```
679  3          CALL SRVC$TAB$HSKP (1);
680  3        END;        /* END OF IF (NTO1NE - NTO1NS) CONDITION */

681  2        IF ((NTO2NE - NTO2NS) >= FRAME$SIZE) OR (NTO2NS > NTO2NE) THEN DO;
                                    /* SERVICE CHAN B */
683  3          CALL SENDSEQ(@TP$14, LENGTH(TP$14));
684  3          IF (NTO2RX (NTO2NS+1) AND 080H) = 080H THEN DO;
                        /* HAVE AN S FRAME */
686  4            CALL SENDSEQ(@TP$17, LENGTH(TP$17));
687  4            IF (NTO2RX (NTO2NS+1) AND 020H) = 020H THEN DO;
689  5              CALL SENDSEQ(@TP$18, LENGTH(TP$18));
690  5              THIS$SEQ$BIT$B = TRUE;
691  5              IF THIS$SEQ$BIT$B = SEQ$BIT$B THEN DO;
693  6                SEQ$BIT$B = NOT SEQ$BIT$B;
694  6                CALL INITACK(4);
695  6                CALL SENDSEQ(@TP$59, LENGTH(TP$59));
696  6              END;
697  5              END;
698  4            ELSE DO;
699  5              CALL SENDSEQ(@TP$19, LENGTH(TP$19));
700  5              THIS$SEQ$BIT$B = FALSE;
701  5              IF THIS$SEQ$BIT$B = SEQ$BIT$B THEN DO;
703  6                SEQ$BIT$B = NOT SEQ$BIT$B;
704  6                CALL INITACK(4);
705  6                CALL SENDSEQ(@TP$59, LENGTH(TP$59));
706  6              END;
707  5              END;        /* END 20H CONDITION */
708  4            END;          /* END 80H CONDITION */

709  3          ELSE DO;    /* HAVE AN I FRAME */

710  4            CALL SENDSEQ(@TP$20, LENGTH(TP$20));
711  4            DESTINATION = DET$DEST$TWO;
712  4            IF DESTINATION = 'NN' THEN DO;
                              /* FRAME DESTINED FOR ANOTHER UNID */
714  5              IF (NTO2RX (NTO2NS+1) AND 020H) = 020H THEN DO;
716  6                CALL SENDSEQ(@TP$51, LENGTH(TP$51));
717  6                INPUT$SEQ$BIT$B = TRUE;
718  6                END;
719  5              ELSE DO;
720  6                CALL SENDSEQ(@TP$52, LENGTH(TP$52));
721  6                INPUT$SEQ$BIT$B = FALSE;
722  6              END;
723  5              CALL BUILD$S$FRAME (2, INPUT$SEQ$BIT$B);
724  5              CALL SENDSEQ(@TP$15, LENGTH(TP$15));
725  5              CALL MOVB( @NTO2RX (NTO2NS), @NTO1TX (TXO1NE),
                     FRAME$SIZE);    /* MOVE FRAME TO CH A OUTPUT TABLE */
726  5              CALL LD$TAB$HSKP (3);
727  5            END;          /* END DEST = 'NN' */

728  4            IF DESTINATION = 'NL' THEN DO;   /* FRAME FOR THIS UNID */
```

```
730   5                   CALL SENDSEQ(@TP$16, LENGTH(TP$16));
731   5                   IF (NTO2RX (NTO2NS+1) AND 020H) = 020H THEN DO;
733   6                       CALL SENDSEQ(@TP$21, LENGTH(TP$21));
734   6                       INPUT$SEQ$BIT$B = TRUE;
735   6                       END;
736   5                   ELSE DO;
737   6                       CALL SENDSEQ(@TP$22, LENGTH(TP$22));
738   6                       INPUT$SEQ$BIT$B = FALSE;
739   6                   END;        /* END 20H CONDITION */
740   5                   CALL BUILD$S$FRAME (2, INPUT$SEQ$BIT$B);
741   5                   CALL SENDSEQ(@TP$46, LENGTH(TP$46));
742   5                   CALL MOVB( @NTO2RX (NTO2NS+2), @NTLCTB (NTLCNE),
                                                    PACKET$SIZE);
743   5                   CALL LD$TAB$HSKP (5);   /* DEST = NL */
744   5               END;        /* END OF DEST = NL CONDITION */
745   4           END;            /* END OF I FRAME */
746   3           CALL SRVC$TAB$HSKP (2);
747   3       END;            /* END OF (NTO2NE - NTO2NS) CONDITION */

748   2       IF ((LCNTNE - LCNTNS) >= PACKET$SIZE) OR (LCNTNS > LCNTNE) THEN DO;
750   3           CALL SENDSEQ(@TP$23, LENGTH(TP$23));
751   3           DESTINATION = DET$DEST$LN;
752   3           IF DESTINATION = 'CA' THEN DO;      /* PACKET TO CHAN A */
754   4               OUT$TAB$FULL = FIND$IFRAME(1);
755   4               IF (NOT OUT$TAB$FULL) THEN DO;
757   5                   CALL SENDSEQ(@TP$24, LENGTH(TP$24));
758   5                   CALL BUILD$I$FRAME(1);
759   5                   CALL SRVC$TAB$HSKP (6);
760   5               END;    /* IF NOT OUT$ */
761   4           END;
762   3           IF DESTINATION = 'CB' THEN DO;      /* PACKET TO CHAN B */
764   4               OUT$TAB$FULL = FIND$IFRAME(2);
765   4               IF (NOT OUT$TAB$FULL) THEN DO;
767   5                   CALL SENDSEQ(@TP$25, LENGTH(TP$25));
768   5                   CALL BUILD$I$FRAME(2);
769   5                   CALL SRVC$TAB$HSKP (6);
770   5               END;    /* IF NOT OUT$ */
771   4           END;
772   3       END;        /* END OF (LCNTNE - LCNTNS) CONDITION */

773   2   END ROUTE$IN;

        /*************************************************************************
        PROCEDURE   ROUTE$OUT   ROUTE FRAMES OUT TO NETWORK

            THE PURPOSE OF THIS PROCEDURE IS TO ROUTE FRAMES FROM THE LOCAL TO
        NETWORK TABLE (LCNTTB) TO ONE OF THE OUTGOING NETWORK PORTS (NTO1TX OR
        NTO2TX) AND TO ROUTE FRAMES FROM THE NETWORK SIDE BACK ONTO THE
        NETWORK.  IT ALSO MAINTAINS FLOW CONTROL AND ERROR RECOVERY BY WAITING FOR
        THE ROUTE$IN PROCEDURE TO RECEIVE POSITIVE ACKNOWLEDGEMENT FOR I FRAMES
        TRANSMITTED BY THIS PROCEDURE.
```

```
                INPUT
                    DATA FRAMES ARE ROUTED VIA EVALUATION OF NTO1TX,
                NTO2TX, AND LCNTTB POINTERS WITH FRAME HEADER ADDRESS INFORMATION.

                PROCESSING
                    THE PROCEDURE CHECKS EACH INPUT TABLE'S POINTERS FOR FRAMES TO BE
                TRANSMITTED ONTO THE NETWORK.  BEFORE ANY TRANSMISSION OCCURS,
                MAX$NETWORK$CODE IS COMPARED AGAINST THE DESTINATION ADDRESS TO INSURE A
                FRAME CANNOT CONTINUE ON THE NETWORK WHEN IT HAS AN ADDRESS GREATER THAN THE
                AVAILABLE NUMBER OF UNIDS.  NET TO NET FRAMES ARE SIMPLY TRANSFERRED TO THE
                NETWORK.  ALL FRAMES WHICH ORIGINATE AT THIS UNID ARE CHECKED TO IDENTIFY
                THE TYPE.  S FRAMES ARE SIMPLY TRANSMITTED.  I FRAMES ARE TRANSMITTED AND
                ENTER A TIME DELAY WAITING FOR A GOOD ACKNOWLEDGEMENT.  IF A GOOD
                ACKNOWLEDGEMENT IS NOT RECEIVED BY THE END OF THE WAIT PERIOD, IT IS
                TRANSMITTED AGAIN UPON THE NEXT CYCLE THROUGH THIS PROCEDURE.

                OUTPUT
                    A FRAME OF DATA IS TRANSMITTED TO ONE OF THE NETWORK CHANNELS.

                INTERFACE
                    THIS PROCEDURE IS CALLED IN AN ENDLESS LOOP BY THE MAIN PROCEDURE.

                NOTES:
                    1.  THERE ARE TWO VERY IMPORTANT PARAETERS RELATING TO THIS PROCEDURE
                THAT MUST BE CONSIDERED PRIOR TO THE MODIFICATION OF THIS PROCEDURE.  THE
                FIRST IS VARIABLE MAX$NETWORK$CODE.  ALL ACTIVE UNIDS ONTHE NETWORK WILL
                START WITH 0 AND PROCEED TO INCREMENT IN A CLOCKWISE MANNER.  IN THIS WAY,
                THE ADDRESS CAN BE COMPARED TO MAX$NETWORK$CODE TO BE SURE THAT NON-EXISTENT
                UNIDS WILL NOT APPEAR IN TRANSMITTED FRAMES.
                    2.  THE SECOND PARAMETER IS MAXNUM.  MAXNUM IS THE MAXIMUM NUMBER OF
                TIMES THE TIMEOUT CYCLE LOOPS THROUGH THE RETRANSMISSION PERIOD FOR AN I
                FRAME.  THIS PERIOD ALLOWS TIME FOR A VALID ACKNOWLEDGEMENT TO BE RECEIVED
                AFTER THE I FRAME IS TRANSMITTED.  THE BASIC PERIOD IS SET THROUGH
                N.INST0$02 FOR 27 MILLISECONDS.  IF MAXNUM = 10, THEN THE WAIT LOOP IS 270
                MILLISECONDS.
                **********************************************************************/
774   1         ROUTE$OUT: PROCEDURE REENTRANT;

                                                    /* SERVICE CHAN A */
775   2           IF ((TXOINC - TXOINS) >= FRAME$SIZE) OR
                          (TXOINS > TXOINC) THEN DO;
777   3             CALL SENDSEQ(@TP$26, LENGTH(TP$26));
778   3             IF (NTO1TX (TXOINS) AND 0FH)
                            <= MAX$NETWORK$CODE THEN DO;
780   4               IF (NTO1TX(TXOINS + 1) AND 80H) = 80H THEN DO;
782   5                 CALL SERVICE$XMIT$A;          /* ITS AN S FRAME */
785   5                 CALL INITACK(5);
784   5                 CALL SENDSEQ(@TP$27, LENGTH(TP$27));
789   5                 END;
790   4               ELSE DO;
```

```
787   5                    IF TIMCHA = FALSE THEN
788   5                        CALL TIME$DELAY$CHA;
789   5                    ELSE DO;
790   6                        CALL SENDSEQ(@TP$27, LENGTH(TP$27));
791   6                        CALL SERVICE$XMIT$A;
792   6                        RETRANS$A = RETRANS$A + 1;
793   6                        CALL TIME$DELAY$CHA;
794   6                    END;
795   5                END;    /* END NTOXTX     = 80H */
796   4                END;    /* END <= MAX$NETWORK$CODE THEN */
797   3            ELSE DO;
798   4                CALL SENDSEQ(@TP$48, LENGTH(TP$48));
799   4                STATTB (11) = STATTB (11) + 1;
800   4                STATTB (14) = STATTB (14) + 1;
801   4                CALL INITACK(3);
802   4            END;        /* END <= MAX$NETWORK$CODE */
803   3            IF RETRANS$A >= MAXRETRANS$A THEN DO;
805   4                CALL INITACK(3);
806   4                CALL SENDSEQ(@TP$56, LENGTH(TP$56));
807   4            END;
808   3        END;    /* END (TX01NE - TX01NS) CONDITION */

                                                    /* SERVICE CHAN B */

809   2        IF ((TX02NE - TX02NS) >= FRAME$SIZE) OR
                     (TX02NS > TX02NE) THEN DO;
811   3            CALL SENDSEQ(@TP$28, LENGTH(TP$28));
812   3            IF (NTO2TX (TX02NS) AND 0FH)
                         <= MAX$NETWORK$CODE THEN DO;
814   4                IF (NTO2TX(TX02NS + 1) AND 80H) = 80H THEN DO;
816   5                    CALL SERVICE$XMIT$B;            /* ITS AN S FRAME */
817   5                    CALL INITACK(4);
818   5                    CALL SENDSEQ(@TP$29, LENGTH(TP$29));
819   5                    END;
820   4                ELSE DO;
821   5                    IF TIMCHB = FALSE THEN
822   5                        CALL TIME$DELAY$CHB;
823   5                    ELSE DO;
824   6                        CALL SENDSEQ(@TP$29, LENGTH(TP$29));
825   6                        CALL SERVICE$XMIT$B;
826   6                        RETRANS$B = RETRANS$B + 1;
827   6                        CALL TIME$DELAY$CHB;
828   6                    END;
829   5                END;    /* END NTOXTX     = 80H */
830   4                END;    /* END <= MAX$NETWORK$CODE THEN */
831   3            ELSE DO;
832   4                CALL SENDSEQ(@TP$47, LENGTH(TP$47));
833   4                STATTB (11) = STATTB (11) + 1;
834   4                STATTB (14) = STATTB (14) + 1;
835   4                CALL INITACK(4);
836   4            END;        /* END <= MAX$NETWORK$CODE */
```

```
 837   3              IF RETRANS$B >= MAXRETRANS$B THEN DO;
 839   4                  CALL INITACK(4);
 840   4                  CALL SENDSEQ(@TP$57, LENGTH(TP$57));
 841   4              END;
 842   3          END;    /* END (TX02NE - TX02NG) CONDITION */

 843   2      END ROUTE$OUT;

              /*************************************************************************
              PROCEDURE READ$LINE

              PURPOSE
                    READS A LINE OF DATA FROM THE HOST ISIS II CONSOLE, THEN INTERPRETED
                  FOR EXECUTING EITHER LOAD ANOTHER TEST MESSAGE IN THE LCNTTB OR STOPPING
                  THE TEST.
              *************************************************************************/
 844   1      READ$LINE: PROCEDURE;
 845   2          DECLARE INDEX WORD;
 846   2          DECLARE LOOP  WORD;

 847   2          INDEX = 0;

 848   2          CALL SENDSEQ(@MSG1, LENGTH(MSG1));
 849   2          ACTUAL = DQ$READ(R$CONN, @BUFFER, 128, @STATUS);
 850   2          CALL ERR$CHK;

 851   2          IF (BUFFER(0) = 'Y') OR (BUFFER(0) = 'y') THEN DO;
 852   3              CALL SENDSEQ(@MSG4, LENGTH(MSG4));
 853   3              ACTUAL = DQ$READ(R$CONN, @BUFFER, 128, @STATUS);
 854   3              CALL ERR$CHK;
 855   3              LOOP = ASC$HEX(BUFFER(0));
 856   3              IF (LOOP >= 1) AND (LOW(LOOP) <= MAX$NETWORK$CODE) THEN DO;
 857   4                  CALL SENDSEQ(@MSG3, LENGTH(MSG3));
 858   4                  ACTUAL = DQ$READ(R$CONN, @BUFFER, 128, @STATUS);
 859   4                  CALL ERR$CHK;
 860   4                  IF (BUFFER(0) >= '1') AND (BUFFER(0) <= '9') THEN
 861   5                      DO INDEX = 1 TO ASC$HEX(BUFFER(0));
 862   6                      CALL LOAD(LOOP);
 863   6                      END;
 864   4              END;
 865   3          END;

 866   2          CALL SENDSEQ(@MSG2, LENGTH(MSG2));
 867   2          ACTUAL = DQ$READ(R$CONN, @BUFFER, 128, @STATUS);
 868   2          CALL ERR$CHK;

 869   2          IF (BUFFER(0) = 'Y') OR (BUFFER(0) = 'y') THEN
 870   2              FOREVER = FALSE;
                  ELSE
 871   2              FOREVER = TRUE;
```

```
574  2      END READ$LINE;
            /*****************************************************************************
                        MAIN  PROGRAM FOR THE NETWORK OPERATING SYSTEM

                THE PURPOSE OF THIS PROCEDURE IS TO PROVIDE THE MAIN LINE CODE OF
            PROCESSING FOR N.OS.

            INPUT       NONE.

            PROCESSING
                THIS PROCEDURE SENDS A HEADER TO THE NETWORK MONITOR CONSOLE,
            INITIALIZES THE NETWORK TABLES VIA INIT$N$TAB, USES INSTO TO INITIALIZE THE
            SIO INTERRUPTS, AND LOOPS ENDLESSLY ROUTING FRAMES IN AND OUT VIA PROCEDURES
            ROUTE$IN AND ROUTE$OUT.

            OUTPUT
                A STARTUP MESSAGE IS SENT TO THE NETWORK MONITOR UPON STARTUP.

            INTERFACE
                THIS PROCEDURE IS THE INITIAL ENTRY POINT FOR N.OS.  IT OPERATES THROUGH
            SINGLE CALLS TO CALL SENDSEQ, INIT$N$TAB, AND INSTO, AND REPETITIVE CALLS TO
            ROUTE$IN AND ROUTE$OUT.

            NOTES:      NONE.
            *****************************************************************************/
375  1      BEGIN:

                /* THE FOLLOWING DQ$xxxxx CALLS MUST BE THE FIRST EXECUTABLE CODE IN
                    THIS MODULE FOR THE ISIS-II CONSOLE I/O TO OPERATE PROPERLY.
                    DO NOT CHANGE THE LOCATION OF THIS CODE OR IT WILL NOT WORK!
                    DO NOT MAKE 'BEGIN:' PUBLIC AND THE START(BEGIN) OPTION WITH
                        LINK-86 OR IT WILL NOT WORK!                              */

                W$CONN = DQ$CREATE (@(4, ':CO:'), @STATUS);
376  1          CALL ERR$CHK;
377  1          CALL DQ$OPEN (W$CONN, 2, 0, @STATUS);
378  1          CALL ERR$CHK;

379  1          R$CONN = DQ$ATTACH (@(4, ':CI:'), @STATUS);
380  1          CALL ERR$CHK;
381  1          CALL DQ$OPEN (R$CONN, 1, 0, @STATUS);
382  1          CALL ERR$CHK;

383  1          CALL SENDSEQ(@STARTUP$HDR, LENGTH(STARTUP$HDR));
384  1          CALL SENDSEQ(@TP$1, LENGTH(TP$1));
385  1          CALL INIT$N$TAB;
386  1          CALL SENDSEQ(@TP$2, LENGTH(TP$2));
387  1          CALL READ$LINE;
388  1          CALL SENDSEQ(@TP$3, LENGTH(TP$3));
389  1          DO WHILE FOREVER;
390  2              CALL SENDSEQ(@TP$4, LENGTH(TP$4));
```

```
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 891   2              CALL ROUTE$IN;
 892   2              CALL SENDSEQ(@TP$42, LENGTH(TP$42));
 893   2              CALL ROUTE$OUT;
 894   2              CALL READ$TAB;
 895   2              CALL SENDSEQ(@TP$45, LENGTH(TP$43));
 896   2              CALL READ$LINE;
 897   2          END;

 898   1          CALL SENDSEQ(@TP$44, LENGTH(TP$44));
 899   1          CALL DQ$CLOSE(W$CONN, @STATUS);
 900   1          CALL ERR$CHK;
 901   1          CALL DQ$CLOSE(R$CONN, @STATUS);
 902   1          CALL ERR$CHK;
 903   1          CALL DQ$DETACH(W$CONN, @STATUS);
 904   1          CALL ERR$CHK;
 905   1          CALL DQ$DETACH(R$CONN, @STATUS);
 906   1          CALL ERR$CHK;
 907   1          CALL DQ$EXIT(0);

 908   1      END MAIN;       /* END MAIN MODULE */

            /******************************** THE END ********************************/

MODULE INFORMATION:

     CODE AREA SIZE     = 125AH   4a90D
     CONSTANT AREA SIZE = 00B8H    318D
     VARIABLE AREA SIZE = 25E2H   9954D
     MAXIMUM STACK SIZE = 002AH     58D
     1629 LINES READ
     0 PROGRAM ERROR(S)

END OF PL/M-86 COMPILATION
```

```
                PROCESSING - THE PROCEDURE DETERMINES THE TABLE TO BE PROCESSED,
                        ADVANCES THE NEXT$EMPTY$BYTE ADDRESS BY ONE PACKET$SIZE,
                        AND ADJUSTS FOR BUFFER WRAP IF NECESSARY.

                OUTPUT - THE SPECIFIED TABLE HAS ITS NEXT$EMPTY$BYTE ADDRESS
                        ADVANCED BY THE LENGTH OF A SINGLE PACKET.

                INTERFACE - THIS PROCEDURE IS CALLED BY PROCEDURE ROUTE$IN
                    AND ROUTE$OUT.

            ************************************************************************/
193   1     LOCTAB$HOUSE: PROCEDURE(TABLE) ;
194   2       DECLARE  TABLE ADDRESS;

196   2       IF (TABLE >=1 AND TABLE <= 11) THEN   /* 6 FOR REAL, 11 FOR SIM */
196   2         DO CASE TABLE;

197   3           ;                       /* CASE ZERO IS NULL */

198   3           DO;                     /* START CASE ONE  */
199   4             LC01NE = LC01NE + DATA$GRAM$SIZE;
                                                /* ADVANCE NEXT$EMPTY ADDRESS */
200   4             IF LC01NE >= LC01SZ THEN
201   4               LC01NE = 0;
202   4           END;

203   3           DO;                     /* START CASE TWO  */
204   4             LC02NE = LC02NE + DATA$GRAM$SIZE;
205   4             IF LC02NE >= LC02SZ THEN
206   4               LC02NE = 0;
207   4           END;

208   3           DO;
209   4             LC03NE = LC03NE + DATA$GRAM$SIZE;
210   4             IF LC03NE >= LC03SZ THEN
211   4               LC03NE = 0;
212   4           END;

213   3           DO;
214   4             LC04NE = LC04NE + DATA$GRAM$SIZE;
215   4             IF LC04NE >= LC04SZ THEN
216   4               LC04NE = 0;
217   4           END;

218   3           ;               /* START OF CASE FIVE  */

219   3           DO;               /* START OF CASE SIX  */
220   4             LCNTNE = LCNTNE + PACKET$SIZE;
221   4             IF LCNTNE >= LCNTSZ THEN
222   4               LCNTNE = 0;
223   4           END;
```

```
                    OUTPUT(PORT$1) = TRANS$STATE;
                    OUTPUT(PORT$2) = TRANS$STATE;
                    OUTPUT(PORT$3) = TRANS$STATE;
                    OUTPUT(PORT$4) = TRANS$STATE;
                END;
            ENABLE;

        END TRNMIT$PKT;
        */
        /*************************************************************************/
        /*  PROCEDURE   SNDSEQ   SENDS DATA TO LOCAL MONITOR FOR TESTING         */
        /*                                                                       */
        /*              THIS PROCEDURE TAKES A MESSAGE STRING AND OUTPUTS IT TO  */
        /*         THE LOCAL MONITOR ATTACHED TO THE 86/12 CARD.                 */
        /*                                                                       */
        /*         INPUT - A ADDRESS TO THE MESSAGE LOCATION IN MEMORY AND THE   */
        /*                 NUMBER OF BYTES TO BE SENT ARE INPUT.                 */
        /*         PROCESSING - THIS PROCEDURE CHECKS THE OUTPUT BUFFER STATUS   */
        /*                 IN A LOOP UNTIL THE BUFFER IS EMPTY. IT PLACES ONE    */
        /*                 BYTE AT A TIME IN THE OUTPUT USART UNTIL THE MESSAGE  */
        /*                 IS DONE.                                              */
        /*         OUTPUT - MESSAGE TO THE USART CHANNEL.                        */
        /*         INTERFACE - THIS PROCEDURE IS CALLED BY THE FOLLOWING         */
        /*                  PROCEDURES: ROUTE$IN, ROUTE$OUT, AND MAIN.           */
        /*************************************************************************/
180   1     ERR$CHK: PROCEDURE;
181   2          IF STATUS <> 0 THEN
182   2               DO;
183   3               CALL ERROR(STATUS);
184   3               CALL EXIT;
185   3          END;
186   2     END ERR$CHK;

187   1     SNDSEQ: PROCEDURE( MSG, TOTAL);
188   2         DECLARE MSG ADDRESS;
189   2         DECLARE TOTAL ADDRESS;

190   2         CALL WRITE( W$CONN, MSG, TOTAL, .STATUS);
191   2         CALL ERR$CHK;

192   2     END SNDSEQ;

        /*************************************************************************
        PROCEDURE  LD$TAB$HSKP     LOAD TABLE HOUSEKEEP

              THE PURPOSE OF THIS PROCEDURE IS TO HOUSEKEEP A SPECIFIED BUFFER
           TABLE AFTER LOADING OF THE USER DATA FROM THE HOST.

           INPUT - THE INPUT IS AN ADDRESS INDICATING THE TABLE REQUIRING
                   CHANGES.
```

```
156   2          LC03SZ = DATA$TABLE$SIZE;

159   2          LC04NS = 0;
160   2          LC04NE = 0;
161   2          LC04SZ = DATA$TABLE$SIZE;

162   2          TX01NS = 0;
163   2          TX01NE = 0;
164   2          TX01SZ = DATA$TABLE$SIZE;

165   2          TX02NS = 0;
166   2          TX02NE = 0;
167   2          TX02SZ = DATA$TABLE$SIZE;

168   2          TX03NS = 0;
169   2          TX03NE = 0;
170   2          TX03SZ = DATA$TABLE$SIZE;

171   2          TX04NS = 0;
172   2          TX04NE = 0;
173   2          TX04SZ = DATA$TABLE$SIZE;

174   2          IX = 0;
175   2          DO WHILE IX < STAT$NBR;
176   3              STATTB(IX) = 0;
177   3              IX = IX + 1;
178   3          END;

179   2      END INIT$LS$TAB;

          /*************************************************************************
          PROCEDURE   TRNMIT$PKT      TRANSMIT A PACKET

          THE PURPOSE OF THIS PROCEDURE IS TO ENABLE THE DATA PORT FOR
               PACKET TRANSMISSION.

          INPUT - THE USART DATA PORT ADDRESS IS INPUT TO TRNMIT$PKT.

          PROCESSING - THE PROCEDURE ENABLES THE SELECTED USART AND SETS THE
               INTERRUPT FOR THE TRANSMISSION OF A PACKET.

          OUTPUT - THE INTERRUPT IS SET ON THE CHANNEL SPECIFIED BY PORT$NUM.

          INTERFACE - THIS PROCEDURE IS CALLED BY PROCEDURE ROUTE$IN.
          *************************************************************************/
          /*         THIS IS A NULL PROCEDURE FOR SIMULATION PURPOSES
          TRNMIT$PKT: PROCEDURE(PORT$NUM);
                      DECLARE  PORT$NUM  BYTE;
              DISABLE;
                  DO CASE PORT$NUM;
                      ;
```

```
                    /* SET PIT #2, REGISTER #0 FOR USART #4 BAUD RATE  */
                    /*  INITIATE RESET ON ALL USARTS  */
                    /*  INITIALIZE THE FOUR USARTS TO: 2 STOP BITS, NO PARITY,  */
                    /*     8 BIT CHARACTERS, AND 16X BAUD RATE     */
                    /*  INITIALIZE THE  8259 PROGRAMMABLE INTERRUPT CONTROLLER  */

132   2             MSGNUM = 0;
133   2             BYTES$SENT$1 = 0;
134   2             BYTES$SENT$2 = 0;
135   2             BYTES$SENT$3 = 0;
136   2             BYTES$SENT$4 = 0;
137   2             TRANS$1$RDY = TRUE;
138   2             TRANS$2$RDY = TRUE;
139   2             TRANS$3$RDY = TRUE;
140   2             TRANS$4$RDY = TRUE;

141   2       END INVINT;

                /*************************************************************************/
                /*  PROCEDURE   INIT$L$TAB   INITIALIZES THE LOCAL TABLES                */
                /*                                                                       */
                /*  THIS PROCEDURE SETS THE LOCAL AND NETWORK TABLES TO THIER            */
                /*       INITIAL VALUES PRIOR TO PROCESSING ANY MESSAGES.                */
                /*                                                                       */
                /*                                                                       */
                /*  INPUTS - NONE                                                        */
                /*  PROCESSING - PUTS INITIAL VALUES IN THE LOCAL TABLES                 */
                /*  OUTPUT - NONE                                                        */
                /*  INTERFACE - CALLED BY THE MAIN PROCEDURE                             */
                /*************************************************************************/
142   1       INIT$L$TAB: PROCEDURE;
143   2           DECLARE  IX  ADDRESS;

144   2           LCNTNS = 0;
145   2           LCNTNE = 0;
146   2           LCNTSZ = PACKET$TABLE$SIZE;

147   2           NTLCNS = 0;
148   2           NTLCNE = 0;
149   2           NTLCSZ = PACKET$TABLE$SIZE;

150   2           LC01NS = 0;
151   2           LC01NE = 0;
152   2           LC01SZ = DATA$TABLE$SIZE;

153   2           LC02NS = 0;
154   2           LC02NE = 0;
155   2           LC02SZ = DATA$TABLE$SIZE;

156   2           LC03NS = 0;
157   2           LC03NE = 0;
```

```
111   2         DECLARE (VAL, I) BYTE;

112   2         TEMP1(I) = ASCII(SHR(VAL,4) AND 0FH);
113   2         TEMP1(I+1) = ASCII(VAL AND 0FH);

114   2     END HEX$ASC;

115   1     ASC$HEX: PROCEDURE(C) BYTE;
116   2         DECLARE C BYTE;

117   2         IF (C >= '0' AND C <= '9') THEN
118   3             RETURN (C-30H);
              ELSE
119   2             IF (C >= 'A' AND C <= 'F') THEN
120   2                 RETURN (C-37H);

              RETURN C;

122   2     END ASC$HEX;

123   1     VALID$HEX: PROCEDURE(H) BYTE;
124   2         DECLARE (H,I) BYTE;

125   2         DO I = 0 TO LAST(ASCII);
126   3             IF H = ASCII(I) THEN
127   3                 RETURN TRUE;
128   3         END;
129   2         RETURN FALSE;

130   2     END VALID$HEX;

              /*************************************************************************/
              /* PROCEDURE    INVINT    INITIALIZES THE HARDWARE PORTS                  */
              /*                                                                       */
              /*   THE PURPOSE OF THIS PROCEDURE IS TO INITIALIZE THE VECTOR           */
              /*      TABLES AND ALL THE LOCAL NETWORK PORTS. THIS INCLUDES THE TIMERS,*/
              /*      INTERRUPT CONTROLLER, PARALLEL PORT ON THE ISBC 86/12, AND THE   */
              /*      USARTS.                                                          */
              /*                                                                       */
              /*   INPUT - NONE                                                        */
              /*   PROCESSING - SETS THE VECTOR INTERRUPT TABLE VALUES AND WRITES THE  */
              /*        CONTROL WORD TO THE PIC, PIT, PPI, AND USARTS.                 */
              /*   OUTPUT - NONE                                                       */
              /*   INTERFACE - CALLED BY MAIN PROGRAM, CALLS DELAY PROCEDURE           */
              /*************************************************************************/
131   1     INVINT: PROCEDURE;

                    /*  INITIALIZE 8255 PROGRAMMABLE PERIPHERAL INTERFACE (PPI)  */
                    /* SET BAUD RATES FOR LOCAL CHANNEL USARTS  */
                    /*  SET PIT #1, REGISTER #1 FOR USART #2 BAUD RATE  */
                    /* SET PIT #1, REGISTER #2 FOR USART #3 BAUD RATE  */
```

```
                'TP$55C          Reading test datagram from TX03TB');
 93   1       DECLARE TP$55D(*) BYTE DATA(CR,LF,
                'TP$55D          Reading test datagram from TX04TB');
 94   1       DECLARE TP$5CA(*) BYTE DATA(CR,LF,
                'TP$5oA          Reading test datagram from LC01TB');
 95   1       DECLARE TP$5oB(*) BYTE DATA(CR,LF,
                'TP$5oB          Reading test datagram from LC02TB');
 96   1       DECLARE TP$5oC(*) BYTE DATA(CR,LF,
                'TP$5oC          Reading test datagram from LC03TB');
 97   1       DECLARE TP$5oD(*) BYTE DATA(CR,LF,
                'TP$5oD          Reading test datagram from LC04TB');

 98   1       DECLARE MSG1(*) BYTE DATA(CR,LF,
                'Do you want to load the test message? ');
 99   1       DECLARE MSG2(*) BYTE DATA(CR,LF,
                'Do you want to stop the test? ');
100   1       DECLARE MSG3(*) BYTE DATA(CR,LF,
                'Load into which host channel (1,2,3,4)? ');
101   1       DECLARE MSG4(*) BYTE DATA(CR,LF,
                'How many datagrams (0 - 9)? ');
102   1       DECLARE MSG5(*) BYTE DATA(CR,LF,
                'Destination network code (1,2,3) = ');
103   1       DECLARE MSG6(*) BYTE DATA(CR,LF,
                'Destination host code (0 - FFH) = ');

                /*************************************************************/
                /*   PROCEDURE  DELAY     CAUSES A ONE SECOND DELAY          */
                /*                                                           */
                /*   THE PURPOSE OF THIS PROCEDURE IS TO ADD DELAY TO PARTS OF THE    */
                /*        INITIALIZATION PROCEDURE THAT IS TIME DEPENDENT.   */
                /*                                                           */
                /*   INPUT - NONE                                            */
                /*   PROCESSING - USES BUILT IN PROCEDURE IN A LOOP          */
                /*   OUTPUT - NONE                                           */
                /*   INTERFACE - CALLED BY INVINT                            */
                /*************************************************************/

104   1       DELAY:PROCEDURE PUBLIC;
105   2            DECLARE  I  BYTE;
106   2          DO I=1 TO 40;
107   3             CALL TIME(250);
                        /* TIME IS A BUILT IN FUNCTION OF PLM80 WHICH CAUSES */
                        /* A DELAY BASED ON THE NUMBER IN PARENS          */
108   3          END;
109   2       END DELAY;

                /*************************************************************
                   PROCEDURES TO CONVERT HEX TO ASCII FOR USE WITH DISPLAYING A FRAME
                *************************************************************/

110   1       HEX$ASC: PROCEDURE(VAL, I);
```

```
                'TP$31          DATA IN NTLCTB DESTINED FOR LOCAL CHANNEL-2');
 68   1     DECLARE     TP$32(*) BYTE DATA(CR,LF,
                'TP$32          DATA IN NTLCTB DESTINED FOR LOCAL CHANNEL-3');
 69   1     DECLARE     TP$33(*) BYTE DATA(CR,LF,
                'TP$33          DATA IN NTLCTB DESTINED FOR LOCAL CHANNEL-4');
 70   1     DECLARE     TP$34(*) BYTE DATA(CR,LF,
                'TP$34          ERROR OCCURED IN NTLCTB TO TXOXTB OUT-PROCESSING');
 71   1     DECLARE     TP$35(*) BYTE DATA(CR,LF,
                'TP$35          END OF ROUTE$IN-ROUTE$OUT LOOP');
 72   1     DECLARE     TP$36(*) BYTE DATA(CR,LF,
                'TP$36     HAVE EXITED ROUTE$IN-ROUTE$OUT LOOP and returned to ISIS',CR,LF);

 73   1     DECLARE TP$40(*) BYTE DATA(CR,LF,
                'TP$40          Packet moved from LCNTTB to NTLCTB');
 74   1     DECLARE TP$50(*) BYTE DATA(CR,LF,
                'TP$50          Channel Number = ');
 75   1     DECLARE TP$51(*) BYTE DATA(CR,LF,
                'TP$51          Destination = ');
 76   1     DECLARE TP$51A(*) BYTE DATA(CR,LF,
                'TP$51A         Destination Network = ');
 77   1     DECLARE TP$51B(*) BYTE DATA(CR,LF,
                'TP$51B         Destination Control Code = ');
 78   1     DECLARE TP$51C(*) BYTE DATA(CR,LF,
                'TP$51C         Destination Country Code = ');
 79   1     DECLARE TP$51D(*) BYTE DATA(CR,LF,
                'TP$51D         Lobits = ');
 80   1     DECLARE TP$51E(*) BYTE DATA(CR,LF,
                'TP$51E         Hibits = ');
 81   1     DECLARE TP$52(*) BYTE DATA(CR,LF,
                'TP$52          Destination Address = ');
 82   1     DECLARE TP$52B(*) BYTE DATA(CR,LF,
                'TP$52b         Source Address = ');
 83   1     DECLARE TP$52A(*) BYTE DATA(CR,LF,
                'TP$52A         Destination Host = ');
 84   1     DECLARE TP$53(*) BYTE DATA(CR,LF,
                'TP$53          Source Address = ');
 85   1     DECLARE TP$53A(*) BYTE DATA(CR,LF,
                'TP$53A         Destination Network Code > Max Network');
 86   1     DECLARE TP$53AA(*) BYTE DATA(CR,LF,
                'TP$53AA        Source Network Code > Max Network');
 87   1     DECLARE TP$53B(*) BYTE DATA(CR,LF,
                'TP$53B         Country Code <> This Country - Sent to UNID 0');
 88   1     DECLARE TP$53C(*) BYTE DATA(CR,LF,
                'TP$53C         Control Code <> 0');
 89   1     DECLARE TP$54(*) BYTE DATA(CR,LF,
                'TP$54          Loaded test datagram in LCOXTB');
 90   1     DECLARE TP$55A(*) BYTE DATA(CR,LF,
                'TP$55A         Reading test datagram from TX01TB');
 91   1     DECLARE TP$55B(*) BYTE DATA(CR,LF,
                'TP$55B         Reading test datagram from TX02TB');
 92   1     DECLARE TP$55C(*) BYTE DATA(CR,LF,
```

```
 42  1    DECLARE     TP$6(*) BYTE DATA(CR,LF,
                      'TP$6           DATA LOCATED IN LOCAL CHANNEL-1' );
 43  1    DECLARE     TP$7(*) BYTE DATA(CR,LF,
                      'TP$7           DATA IS LC01TB TO TX0XTB TRANSFER' );
 44  1    DECLARE     TP$8(*) BYTE DATA(CR,LF,
                      'TP$8           DATA IS LC01TB TO LCNTTB TRANSFER' );
 45  1    DECLARE     TP$9(*) BYTE DATA(CR,LF,
                      'TP$9           ERROR OCCURED IN LOCAL CHANNEL-1 IN-PROCESSING' );
 46  1    DECLARE     TP$10(*) BYTE DATA(CR,LF,
                      'TP$10          DATA LOCATED IN LOCAL CHANNEL-2' );
 47  1    DECLARE     TP$11(*) BYTE DATA(CR,LF,
                      'TP$11          DATA IS LC02TB TO TX0XTB TRANSFER' );
 48  1    DECLARE     TP$12(*) BYTE DATA(CR,LF,
                      'TP$12          DATA IS LC02TB TO LCNTTB TRANSFER' );
 49  1    DECLARE     TP$13(*) BYTE DATA(CR,LF,
                      'TP$13          ERROR OCCURED IN LOCAL CHANNEL-2 IN PROCESSING' );
 50  1    DECLARE     TP$14(*) BYTE DATA(CR,LF,
                      'TP$14          DATA LOCATED IN LOCAL CHANNEL-3' );
 51  1    DECLARE     TP$15(*) BYTE DATA(CR,LF,
                      'TP$15          DATA IS LC03TB TO TX0XTB TRANSFER' );
 52  1    DECLARE     TP$16(*) BYTE DATA(CR,LF,
                      'TP$16          DATA IS LC03TB TO LCNTTB TRANSFER' );
 53  1    DECLARE     TP$17(*) BYTE DATA(CR,LF,
                      'TP$17          ERROR OCCURED IN LOCAL CHANNEL-3 IN PROCESSING' );
 54  1    DECLARE     TP$18(*) BYTE DATA(CR,LF,
                      'TP$18          DATA LOCATED IN LOCAL CHANNEL-4' );
 55  1    DECLARE     TP$19(*) BYTE DATA(CR,LF,
                      'TP$19          DATA IS LC04TB TO TX0XTB TRANSFER' );
 56  1    DECLARE     TP$20(*) BYTE DATA(CR,LF,
                      'TP$20          DATA IS LC04TB TO LCNTTB TRANSFER' );
 57  1    DECLARE     TP$21(*) BYTE DATA(CR,LF,
                      'TP$21          ERROR OCCURED IN LOCAL CHANNEL-4 IN PROCESSING' );
 58  1    DECLARE     TP$22(*) BYTE DATA(CR,LF,
                      'TP$22          ENTERING ROUTE$OUT PROCEDURE' );
 59  1    DECLARE     TP$23(*) BYTE DATA(CR,LF,
                      'TP$23          OUTGOING DATA IS IS LCLCTB');
 60  1    DECLARE     TP$24(*) BYTE DATA(CR,LF,
                      'TP$24          DATA IN LCOXTB DESTINED FOR LOCAL CHANNEL-1');
 61  1    DECLARE     TP$25(*) BYTE DATA(CR,LF,
                      'TP$25          DATA IN LCOXTB DESTINED FOR LOCAL CHANNEL-2');
 62  1    DECLARE     TP$26(*) BYTE DATA(CR,LF,
                      'TP$26          DATA IN LCOXTB DESTINED FOR LOCAL CHANNEL-3');
 63  1    DECLARE     TP$27(*) BYTE DATA(CR,LF,
                      'TP$27          DATA IN LCOXTB DESTINED FOR LOCAL CHANNEL-4');
 64  1    DECLARE     TP$28(*) BYTE DATA(CR,LF,
                      'TP$28          ERROR OCCURED IN LCOXTB OUT$PROCESSING');
 65  1    DECLARE     TP$29(*) BYTE DATA(CR,LF,
                      'TP$29          OUTGOING DATA IS IN NTLCTB');
 66  1    DECLARE     TP$30(*) BYTE DATA(CR,LF,
                      'TP$30          DATA IN NTLCTB DESTINED FOR LOCAL CHANNEL-1');
 67  1    DECLARE     TP$31(*) BYTE DATA(CR,LF,
```

```
                        STATTB (STAT$NBR) BYTE;

                    /* DECLARATIONS FOR FLAGS AND TABLES IN SYSTEM MEMORY */

 32  1      DECLARE
                        INTERUPT    BYTE,                   /* 88/45 INTERRUPT BYTE */
                        (SPARE1,SPARE2,SPARE3) BYTE,        /* SPARE LOCATIONS */
                        (TO$HOST, TO$HOST$BUSY) BYTE,       /* BOOLEAN FLAGS */
                        (TOHOSTNS, TOHOSTNE) ADDRESS,       /* TABLE ADDRESSS */
                        NTLOTB (PACKET$TABLE$SIZE)  BYTE,   /* TABLE OF 10 PACKETS */

                        (TO$NET, TO$NET$BUSY) BYTE,         /* BOOLEAN FLAGS */
                        (TONETNS, TONETNE) ADDRESS,         /* TABLE ADDRESSS */
                        LONTTB (PACKET$TABLE$SIZE) BYTE;    /* TABLE OF 10 PACKETS */

                          /*  MISCELLANEOUS DECLARATIONS  */

 33  1      DECLARE     FOREVER   BYTE;
 34  1      DECLARE     BUSY        LITERALLY    '0FFH',
                        TRUE        LITERALLY    '0FFH',
                        FALSE       LITERALLY    '00H',
                        NMBR$MSK    LITERALLY    '07H',
                        CR          LITERALLY    '0DH',
                        LF          LITERALLY    '0AH',
                        SOURCE      LITERALLY    '12',
                        DESTIN      LITERALLY    '16',
                        ESC         LITERALLY    '1BH';

 35  1      DECLARE     DESTINATION  ADDRESS,   /* DESTINATION OF THE PACKET  */
                        DESTINATION$ADDRESS BYTE, /* DESTIN ADDR OF DATAGRAM */
                        SOURCE$ADDRESS BYTE;      /* SOURCE ADDR OF DATAGRAM */

                          /*  INTERNAL VARIABLES USED IN THIS MODULE  */

 36  1      DECLARE     STARTUP$HDR(*) BYTE DATA(CR,LF,
                '                       UNID 11 #2 LOCAL OS',CR,LF,
                '                       VERS 1.1,  30 SEP 84',CR,LF,
                '                          EXECUTING ',CR,LF);

                    /* THE FOLLOWING TEST POINTS ARE USED TO FOLLOW THE DATA WITHIN THE UNID */

 37  1      DECLARE     TP$1(*) BYTE DATA(CR,LF,
                'TP$1           ENTERING INIT$L$TAB PROCEDURE');
 38  1      DECLARE     TP$2(*) BYTE DATA(CR,LF,
                'TP$2           ENTERING INIT$U$SHTAB PROCEDURE');
 39  1      DECLARE     TP$3(*) BYTE DATA(CR,LF,
                'TP$3           ENTERING INVINT PROCEDURE');
 40  1      DECLARE     TP$4(*) BYTE DATA(CR,LF,
                'TP$4           STARTING ROUTE$IN-ROUTE$OUT LOOP' );
 41  1      DECLARE     TP$5(*) BYTE DATA(CR,LF,
                'TP$5           ENTERING ROUTE$IN PROCEDURE' );
```

```
                /*    DATA TABLES USED IN THIS PROGRAM                                  */
                /************************************************************************/

 31   1         DECLARE     LC01TB (DATA$TABLE$SIZE) BYTE,
                          LC01NS ADDRESS,
                          LC01NE ADDRESS,
                          LC01SZ ADDRESS,

                          LC02TB (DATA$TABLE$SIZE) BYTE,
                          LC02NS ADDRESS,
                          LC02NE ADDRESS,
                          LC02SZ ADDRESS,

                          LC03TB (DATA$TABLE$SIZE) BYTE,
                          LC03NS ADDRESS,
                          LC03NE ADDRESS,
                          LC03SZ ADDRESS,

                          LC04TB (DATA$TABLE$SIZE) BYTE,
                          LC04NS ADDRESS,
                          LC04NE ADDRESS,
                          LC04SZ ADDRESS,

                          TX01TB(DATA$TABLE$SIZE) BYTE,
                          TX01NS ADDRESS,
                          TX01NE ADDRESS,
                          TX01SZ ADDRESS,

                          TX02TB(DATA$TABLE$SIZE) BYTE,
                          TX02NS ADDRESS,
                          TX02NE ADDRESS,
                          TX02SZ ADDRESS,

                          TX03TB(DATA$TABLE$SIZE) BYTE,
                          TX03NS ADDRESS,
                          TX03NE ADDRESS,
                          TX03SZ ADDRESS,

                          TX04TB(DATA$TABLE$SIZE) BYTE,
                          TX04NS ADDRESS,
                          TX04NE ADDRESS,
                          TX04SZ ADDRESS,

                          LCNTNS ADDRESS,
                          LCNTNE ADDRESS,
                          LCNTSZ ADDRESS,

                          NTLCNS ADDRESS,
                          NTLCNE ADDRESS,
                          NTLCSZ ADDRESS,
```

```
                                /* CC WHERE THIS UNID RESIDES */
                        MAX$COUNTRY$CODE LITERALLY '01',
                                /* INDICATES COUNTRY$CODES IN USE */
                        MAX$NETWORK$CODE LITERALLY '03';
                                /* INDICATES UNIDS OPERATIONAL IN NET */

        /*************************************************************************/
        /*  DEFINITIONS FOR THE LOCAL SERIAL INPUT/OUTPUT CARD AND 86/12 PPI     */
        /*************************************************************************/

25  1       DECLARE  CNTRL$8255  LITERALLY '0CEH',/* 8255 CONTROL PORT ON 86/12 */
                     A$IN        LITERALLY '0C8H',  /* I/O INPUT PORT ADDRESS  */
                     B$OUT       LITERALLY '0CAH',  /* I/O OUTPUT PORT ADDRESS */
                     C$CNTRL     LITERALLY '0CCH',  /* I/O CONTROL PORT ADDRESS */
                     ICW1$OR$OCW2  LITERALLY '0C0H',   /* PORT ADDRESS FOR PIC */
                     ICW5        LITERALLY '0C2H',/* PORT ADDRESS FOR PIC MODE */
                     RCV$STATE   LITERALLY '00010110B', /* MODE INSTRUCTION FOR  */
                                                        /* 8251 USART RCV INT    */
                     TRANS$STATE LITERALLY '00110111B', /* MODE INSTRUCTION FOR */
                                                        /* 8251 RCV & XMIT INT */
                     ROTATE$PRIORITY$SET  LITERALLY '10100000B';
                                                        /* ROTATES PRIORITY */
                                                        /* FOR EQUAL PRIORITY TO */
                                                        /* ALL I/O PORTS       */

        /*************************************************************************/
        /*   ADDITIONAL GENERAL DECLARES NEEDED FOR THIS PROGRAM                 */
        /*************************************************************************/

26  1   DECLARE  BAUD$LSB       BYTE,
                 BAUD$MSB       BYTE,
                 NUM$BYTES$SENT ADDRESS,
                 TRANS$1$RDY  BYTE,
                 TRANS$2$RDY  BYTE,
                 TRANS$3$RDY  BYTE,
                 TRANS$4$RDY  BYTE,
                 MSGNUM       BYTE;

27  1   DECLARE    TEMP1(*) BYTE INITIAL('0000000000000000'),
                   TEMP2(*) BYTE INITIAL('0000000000000000');

28  1   DECLARE    BYTES$SENT$1 BYTE,
                   BYTES$SENT$2 BYTE,
                   BYTES$SENT$3 BYTE,
                   BYTES$SENT$4 BYTE;

29  1   DECLARE    J            BYTE;

30  1   DECLARE  ISKP$ERR  ADDRESS;

        /*************************************************************************/
```

```
 9  2      END EXIT;

10  1      ERROR:  PROCEDURE (ERRNUM) EXTERNAL;
11  2              DECLARE ERRNUM ADDRESS;
12  2      END ERROR;

13  1      DECLARE ACTUAL ADDRESS;
14  1      DECLARE STATUS ADDRESS;
15  1      DECLARE BUFFER (128) BYTE;
16  1      DECLARE R$CONN LITERALLY '1';
17  1      DECLARE W$CONN LITERALLY '0';
18  1      DECLARE ERRNUM ADDRESS;
19  1      DECLARE CRLF(*) BYTE DATA(0DH,0AH);
20  1      DECLARE     MESSAGE(*) BYTE DATA(0DH, 0AH,
                'THIS IS THE TEST MESSAGE                    THIS IS THE TEST
                                              MESSAGE!!!!!');
21  1      DECLARE     ASCII(*) BYTE DATA('0123456789ABCDEF');
22  1      DECLARE CHAN$NUM ADDRESS;


23  1      DECLARE
                L$RI$DEST$ERR   LITERALLY '000H',   /* LOCAL ROUTE$IN ERROR */
                L$RO$DEST$ERR   LITERALLY '01H';    /* LOCAL ROUTE$OUT ERROR */

                    /* THE FOLLOWING ARE UNID DEFINED VARIABLES */
                    /* NOTE: THESE VARIABLES MAY CHANGE DEPENDING ON THE
                             SOFTWARE CONFIGURATION USED WITHIN THE DELNET */

24  1       DECLARE    DATA$GRAM$SIZE  LITERALLY '128',/* NUMBER OF BYTES FROM HOST*/
                       PACKET$SIZE     LITERALLY '133',    /* DATA PACKET + HEADER */
                       PACKETS$IN$TABLE LITERALLY '10',
                       STAT$NBR        LITERALLY '20', /* STATUS ENTRIES IN STATTB */
                       DATA$TABLE$SIZE LITERALLY '1280',/* NUMBR OF BYTES */
                       PACKET$TABLE$SIZE LITERALLY '1330', /* NUMBR OF BYTES */
                       TCP$DATA$SIZE  LITERALLY '72',     /* TCP DATA SIZE */

                       /* FOLLOWING ARE NETWORK DEFINED VARIABLES */
                       /* NOTES:1. THIS$UNID$NBR MUST REFLECT WHICH UNID THIS IS.
                            2. THIS$COUNTRY$CODE MUST REFLECT THE AREA TO WHICH
                               THIS UNID IS LOCATED.
                            3. MAX$COUNTRY$CODE WILL INDICATE WHICH COUNTRY CODES
                               ARE CURRENTLY OPERATIONAL. CC=0000 IS RESERVED FOR
                               THE DELNET MONITOR.
                            4. MAX$NETWORK$CODE WILL INDICATE HOW MANY UNIDS ARE
                               CURRENTLY OPERATIONAL WITHIN A PARTICULAR COUNTRY.
                            5. FOR DETAILED INFORMATION ON THE ABOVE REFER TO
                               PHISTER'S THESIS, APPENDIX D.  */

                     THIS$UNID$NBR    LITERALLY '02',
                                 /* UNIQUE ADDRESS FOR THIS UNID */
                     THIS$COUNTRY$CODE LITERALLY '01',
```

```
ISIS-II PL/M-80 V3.0 COMPILATION OF MODULE MAIN
OBJECT MODULE PLACED IN NEWL00.OBJ
COMPILER INVOKED BY:  PLM80 NEWL00.SRC

            $TITLE('LOCAL NETWORK TEST PROGRAM, 30 SEP 1984')

             /*************************************************************/
             /*                                                           */
             /*  DATE:             30 Sep 1984                            */
             /*  VERSION:          1.0                                    */
             /*                                                           */
             /*  TITLE:            Network Layer Simulation               */
             /*  FILE NAME:        NEWL00.SRC                             */
             /*  OWNER:            C. T. Childress                        */
             /*                                                           */
             /*  SOFTWARE SYSTEM:  Intel System III, ISIS II (V 4.2, 4.3) */
             /*  USE:              Simulate the function of the network   */
             /*                    layer software on the System III       */
             /*                                                           */
             /*  CONTENTS:         Source code listing                    */
             /*                                                           */
             /*************************************************************/

            /*****************************************************************************
             PROLOGUE - MODULE L.MAIN$U1                    DATE TRANSLATED:  1 SEP 83
                                                           DATE LAST MODIFIED: 30 SEP 84

                  THE PURPOSE OF THIS MODULE IS TO PROVIDE THE UNID LOCAL
                OPERATING SYSTEM (L.OS) WITH THE MAIN LINE OF PROCESSING. THE L.OS
                IS REQUIRED TO INPUT AND OUTPUT DATA FROM EITHER THE FOUR LOCAL
                CHANNELS OR THE TWO NETWORK CHANNELS.  THIS MODULE SUPPORTS THE
                X.25, NETWORK LAYER, SOFTWARE, AND THE INTERNET PROTOCOL (IP)
                INTERACTION WITH THE HOSTS.
                      THIS MODULE CONSISTS OF THE MAIN LINE PROCEDURE L.MAIN$U1,
                AND SUBORDINATE PROCEDURES BUILD$I$PACKET, DET$ADDR, LD$TAB$HSKP,
                SRVC$TAB$HSKP, TRNMIT$PKT, ROUTE$IN, AND ROUTE OUT.
                      ALL OF THESE ROUTINES ARE CONVERTED FROM THE PL/Z PROGRAMS
                ORIGINALLY WRITTEN BY CAPT PAUL PHISTER FOR THE Z-80 UNIDS.
            *****************************************************************************/
  1         1       MAIN: DO;

  2         1       READ:    PROCEDURE (AFTN, BUFFER, COUNT, ACTUAL, STATUS) EXTERNAL;
  3         2              DECLARE (AFTN, BUFFER, COUNT, ACTUAL, STATUS) ADDRESS;
  4         2       END READ;

  5         1       WRITE:   PROCEDURE (AFTN, BUFFER, COUNT, STATUS) EXTERNAL;
  6         2              DECLARE (AFTN, BUFFER, COUNT, STATUS) ADDRESS;
  7         2       END WRITE;

  8         1       EXIT:    PROCEDURE EXTERNAL;
```

2. Network Layer Simulation

The purpose of this program is to simulate the network layer software on the Intel System III software development system.

```
224   3              DO;                /* CASE SEVEN IS NULL */
225   4                NTL0NE = NTL0NE + PACKET$SIZE;
226   4                IF NTL0NE >= NTL0SZ THEN
227   4                    NTL0NE = 0;
228   4              END;

229   3              DO;
230   4                TX01NE = TX01NE + DATA$GRAM$SIZE;
231   4                IF TX01NE >= TX01SZ THEN
232   4                    TX01NE = 0;
233   4              END;

234   3              DO;
235   4                TX02NE = TX02NE + DATA$GRAM$SIZE;
236   4                IF TX02NE >= TX02SZ THEN
237   4                    TX02NE = 0;
238   4              END;

239   3              DO;
240   4                TX03NE = TX03NE + DATA$GRAM$SIZE;
241   4                IF TX03NE >= TX03SZ THEN
242   4                    TX03NE = 0;
243   4              END;

244   3              DO;
245   4                TX04NE = TX04NE + DATA$GRAM$SIZE;
246   4                IF TX04NE >= TX04SZ THEN
247   4                    TX04NE = 0;
248   4              END;

249   3            END;

250   2            ELSE HSKP$ERR = HSKP$ERR + 1;

251   2      END LD$TAB$HSKP;

              /*************************************************************************
               PROCEDURE   SRVC$TAB$HSKP       SERVICE TABLE HOUSEKEEP

                        THE PURPOSE OF THIS PROCEDURE IS TO HOUSEKEEP A SPECIFIED
                      BUFFER TABLE AFTER SERVICING (REMOVING A PACKET).

                  INPUT - THE INPUT IS AN ADDRESS VALUE INDICATING THE TABLE THAT
                          REQUIRES HOUSEKEEPING.

                  PROCESSING - THE PROCEDURE DETERMINES THE TABLE TO BE PROCESSED,
                          ADVANCES THE NEXT$BYTE$TO$BE$SERVICED ADDRESS BY A PACKET$SIZE,
                          AND ADJUSTS FOR BUFFER WRAP IF NECESSARY.

                  OUTPUT - THE SPECIFIED TABLE HAS ITS NEXT$BYTE$TO$BE$SERVICED ADDRESS
                          ADVANCED BY THE LENGTH OF A SINGLE PACKET.
```

```
                    INTERFACE - THIS PROCEDURE IS CALLED BY PROCEDURE ROUTE$IN
                        AND ROUTE$OUT.
                    ************************************************************************/
252   1     SRVC$TAB$HSKP: PROCEDURE(TAB) ;
253   2       DECLARE  TAB  ADDRESS;

254   2       IF (TAB >= 1 AND TAB <= 11) THEN  /* 7 FOR REAL, 11 FOR SIM */
255   2         DO CASE TAB;

256   3           ;                   /*  CASE ZERO IS NULL  */

257   3           DO;                 /*  CASE ONE STARTS HERE  */
258   4             LC01NS = LC01NS + DATA$GRAM$SIZE;
259   4             IF LC01NS >= LC01SZ THEN
260   4               LC01NS = 0;
261   4           END;

262   3           DO;                 /*  CASE TWO STARTS HERE  */
263   4             LC02NS = LC02NS + DATA$GRAM$SIZE;
264   4             IF LC02NS >= LC02SZ THEN
265   4               LC02NS = 0;
266   4           END;

267   3           DO;
268   4             LC03NS = LC03NS + DATA$GRAM$SIZE;
269   4             IF LC03NS >= LC03SZ THEN
270   4               LC03NS = 0;
271   4           END;

272   3           DO;                 /*  CASE FOUR STARTS HERE  */
273   4             LC04NS = LC04NS + DATA$GRAM$SIZE;
274   4             IF LC04NS >= LC04SZ THEN
275   4               LC04NS = 0;
276   4           END;

277   3           ;                   /*  CASE FIVE STARTS HERE  */

278   3           DO;       /*  CASE SIX IS A NULL STATEMENT  */
279   4             LCNTNS = LCNTNS + PACKET$SIZE;
280   4             IF LCNTNS >= LCNTSZ THEN
281   4                 LCNTNS = 0;
282   4           END;

283   3           DO;                 /*  CASE SEVEN STARTS HERE  */
284   4             NTLCNS = NTLCNS + PACKET$SIZE;
285   4             IF NTLCNS >= NTLCSZ THEN
286   4                 NTLCNS = 0;
287   4           END;

                    /* CASES 8, 9, 10, 11 FOR TX01(2,3,4) ARE NOT REQUIRED AS */
```

```
                        /* THE TX0XNS POINTERS ARE INCREMENTED AND CHECKED IN THE */
                        /* TRANSMIT DATAGRAM ROUTINES                             */

288   3                 DO;
289   4                   TX01NS = TX01NS + DATA$GRAM$SIZE;
290   4                   IF TX01NS >= TX01SZ THEN
291   4                       TX01NS = 0;
292   4                 END;

293   3                 DO;
294   4                   TX02NS = TX02NS + DATA$GRAM$SIZE;
295   4                   IF TX02NS >= TX02SZ THEN
296   4                       TX02NS = 0;
297   4                 END;

298   3                 DO;
299   4                   TX03NS = TX03NS + DATA$GRAM$SIZE;
300   4                   IF TX03NS >= TX03SZ THEN
301   4                       TX03NS = 0;
302   4                 END;

303   3                 DO;
304   4                   TX04NS = TX04NS + DATA$GRAM$SIZE;
305   4                   IF TX04NS >= TX04SZ THEN
306   4                       TX04NS = 0;
307   4                 END;

308   3               END;

309   2               ELSE  HSKP$ERR = HSKP$ERR + 1;
310   2           END SRVC$TAB$HSKP;

/*************************************************************************/
/* PROCEDURE  BUILD$I$PACKET  PROCEDURE FOR TRANSFORMING THE USER DATA  */
/*                            INTO A DATA$PACKET FOR TRANSFER TO THE    */
/*                            NETWORK SIDE OF THE UNID.                 */
/*                                                                      */
/*            THE PURPOSE OF THIS PROCEDURE IS TO TRANSFORM THE HOST'S*/
/*        USER DATA DELIVERED TO ONE OF THE LOCAL INPUT BUFFERS INTO A */
/*        DATA$PACKET TO BE PLACED IN THE LOCAL TO NETWORK BUFFER. THIS*/
/*        PROCEDURE ADDS THE FIVE HEADER BYTES, AS FOLLOWS:            */
/*           1.  1 BYTE FOR THE DESTINATION ADDRESS.                   */
/*           2.  1 BYTE FOR THE SOURCE ADDRESS.                        */
/*           3.  1 BYTE FOR THE SEQUENCE NUMBER.                       */
/*           4.  1 BYTE FOR A SPARE  (SPARE$01).                       */
/*           5.  1 BYTE FOR A SPARE  (SPARE$02).                       */
/*                                                                     */
/*       INPUT - THIS PROCEDURE RECEIVES AN ADDRESS THAT INDICATES THE */
/*               LOCAL INPUT BUFFER WHERE THE INCOMING HOST DATA IS    */
/*               LOCATED.                                              */
/*      PROCESSING - THE PROCEDURE BEGINS WITH THE PASSING OF THE TABLE*/
```

```
                /*              WHERE THE HOST'S DATA IS LOCATED. THE SOURCE AND        */
                /*              DESTINATION ADDRESS (SOURCE$ADDRESS, DESTINATION$       */
                /*              ADDRESS)                                                */
                /*              IS SUPPLIED BY THE DET$ADDR PROCEDURE. FOR NOW, THE     */
                /*              SEQUENCE NUMBER AND BOTH SPARE BYTES ARE SET TO ZERO.   */
                /*              THE FUTURE, THESE BYTES WILL REFLECT X.25 PROTOCOL.     */
                /*                                                                      */
                /*      OUTPUT - THIS PROCEDURE PLACES THE FIRST FIVE BYTES INTO THE    */
                /*              LOCAL TO NETWORK BUFFER TABLE BEFORE THE PACKET IS      */
                /*              TRANSFERED OVER TO THE NETWORK SIDE OF THE UNID.        */
                /*                                                                      */
                /*      INTERFACE - THE PROCEDURE IS CALLED FROM PROCEDURE ROUTE$IN FOR*/
                /*              THOSE DATA PACKETS DESTINED FOR THE NETWORK ONLY.       */
                /*                                                                      */
                /*      NOTE:  THE HEADER INFORMATION SUPPLIED IS FOR DATAGRAM SERVICE */
                /*             ONLY. ALSO, THE SEQUENCE AND SPARE BYTES ARE SET TO ZERO*/
                /*             TO ALLOW THE UNIDS MINIMAL OPERATIONAL CAPABILITY. FOR  */
                /*             FUTURE SOFTWARE ENHANCEMENTS THIS MUST BE MODIFIED.     */
                /*************************************************************************/
311   1     BUILD$I$PACKET: PROCEDURE(TABLE$PTR) ;
312   2                     DECLARE TABLE$PTR ADDRESS,
                                    LCOXTB BASED TABLE$PTR(1) BYTE;

313   2              LCNTTB(LCNTNE + 0) = DESTINATION$ADDRESS;
314   2              LCNTTB(LCNTNE + 1) = SOURCE$ADDRESS;
315   2              LCNTTB(LCNTNE + 2) = 0;
316   2              LCNTTB(LCNTNE + 3) = 0;
317   2              LCNTTB(LCNTNE + 4) = 0;

318   2              CALL MOVE(DATAGRAM$SIZE, TABLE$PTR, .LCNTTB(LCNTNE+5));

319   2              CALL LD$TAB$HSKP(6);

320   2      END BUILD$I$PACKET;

                /*************************************************************************
                 PROCEDURE DET$ADDR  DETERMINES THE DESTINATION OF DATA FROM LOCAL HOST

                THE PURPOSE OF THIS PROCEDURE IS TO DETERMINE THE DESTINATION OF DATA
                     COMING FROM A HOST CONNECTED TO LOCAL CHANNEL-1.

                INPUT - THE INPUT IS A TWO CHARACTER ASCII VALUE INDICATING THE TABLE
                     LOCATION OF THE PACKET TO BE EVALUATED AND A LOCATION FOR THE
                     DESTINATION TO BE PLACED..

                PROCESSING - THE PROCEDURE FIRST EXTRACTS THE CONTROL$CODE FROM THE
                     INCOMMING DATA TO DETERMINE WHICH ROUTING SCHEME IS USED. THE
                     COUNTRY$CODE AND NETWORK$CODE ARE THEN EXTRACTED TO DETERMINE
                     THE DATA'S DESTINATION. IF THE DATA IS DESTINED FOR THE NETWORK
                     SIDE OF THE UNID THEN THE HOST$CODE IS ALSO EXTRACTED SO THAT
                     THE DESTINATION$ADDRESS CAN BE DETERMINED.
```

```
                OUTPUT - THIS PROCEDURE PLACES THE DESTINATION ('LN' OR 'LL') IN
                     MEMORY FOR THE PASSING ROUTINE AND IT RETURNS THE DESTINATION$
                     ADDRESS. AN EXAMPLE OF A DESTINATION$ADDRESS IS 21, WHICH
                     INDICATES UNIT=2 AND CHANNEL=1.

                INTERFACE - THIS PROCEDURE IS CALLED BY PROCEDURE ROUTE$IN.

                NOTES: 1. BYTE AND 0FH WILL MASK OUT THE UPPER 4-BITS.
                       2. BYTE AND 0F0H WILL MASK OUT THE LOWER 4-BITS.
                       3. BYTE / 01H WILL RETURN A VALUE 0-15 FROM THE LOWER 4-BITS.
                       4. BYTE / 10H WILL RETURN A VALUE 0-15 FROM THE UPPER 4-BITS.
                ************************************************************************/

321   1         DET$ADDR: PROCEDURE(TABLE$PTR);

322   2         DECLARE LOBITS BYTE,
                          HIBITS BYTE,
                          CONTROL$CODE BYTE,
                          COUNTRY$CODE BYTE,
                          NETWORK$CODE BYTE,
                          HOST$CODE BYTE,
                          SRC$HOST$CODE BYTE,
                          SRC$NET$CODE BYTE,
                          SRC$CONT$CODE BYTE,
                          SRC$CONTRY$CODE BYTE,
                          TABLE$PTR ADDRESS,
                          LCOXTB BASED TABLE$PTR(1) BYTE;

323   2             LOBITS = 0;
324   2             HIBITS = 0;
325   2             CONTROL$CODE = 0;
326   2             COUNTRY$CODE = 0;
327   2             NETWORK$CODE = 0;
328   2             HOST$CODE = 0;
329   2             DESTINATION$ADDRESS = 0;
330   2             SOURCE$ADDRESS = 0;
331   2             DESTINATION = 8;

332   2             CONTROL$CODE = LCOXTB(16) AND 0FH;
333   2             IF CONTROL$CODE = 00 THEN
334   2                 DO;
335   3                 COUNTRY$CODE = (ROR(LCOXTB(16), 4) AND 0FH);
336   3                 IF COUNTRY$CODE = THIS$COUNTRY$CODE THEN
337   3                     DO;
338   4                     NETWORK$CODE = LCOXTB(17) AND 0FH;
339   4                     IF (NETWORK$CODE <= MAX$NETWORK$CODE) THEN
340   4                         DO;
341   5                         IF (COUNTRY$CODE <> THIS$COUNTRY$CODE) OR
                                      ((NETWORK$CODE)<> THIS$UNIT$NBR) THEN
342   6                             DESTINATION = 6;        /* LOC TO NET */
                                  ELSE
```

```
343   5                       DESTINATION = 5;        /* LOC TO LOC */
344   5                   LOBITS = (ROR(LCOXTB(17), 4) AND 0FH);
345   5                   HIBITS = (ROL(LCOXTB(18), 4) AND 0F0H);
346   5                   HOST$CODE = LOBITS OR HIBITS;
347   5                   IF (HOST$CODE >=0) AND (HOST$CODE <= 63) THEN
348   5                       DESTINATION$ADDRESS = NETWORK$CODE OR 10H;
                          ELSE
349   5                       IF (HOST$CODE >=64) AND (HOST$CODE <= 127) THEN
350   5                           DESTINATION$ADDRESS = NETWORK$CODE OR 20H;
                              ELSE
351   5                           IF (HOST$CODE >= 128) AND (HOST$CODE <= 191) THEN
352   5                               DESTINATION$ADDRESS = NETWORK$CODE OR 30H;
                                  ELSE
353   5                                 IF (HOST$CODE >= 192) AND (HOST$CODE <=255) THEN
354   5                                   DESTINATION$ADDRESS = NETWORK$CODE OR 40H;
                          END;
                      ELSE
356   4                   DO;
357   5                   CALL SNDSEQ(.TP$53A, SIZE(TP$53A));
358   5                   STATTB(04) = STATTB(04) + 1;
359   5                   STATTB(00) = STATTB(00) + 1;
360   5                   END;
361   4                   END;
                  ELSE
362   3                   DO;     /* NOT FOR THIS COUNTRY, SEND TO NETWORK/UNID 0 */
363   4                   CALL SNDSEQ(.TP$53B, SIZE(TP$53B));
364   4                   STATTB(03) = STATTB(03) + 1;
365   4                   STATTB(00) = STATTB(00) + 1;
366   4                   END;
367   3                   END;
              ELSE
368   2                   DO;
                           /* IT IS AT THIS POINT THAT OTHER IP CONTROL CODES WILL
                                 BE INCORPORATED INTO THE NETWORK  */
369   3                   CALL SNDSEQ(.TP$53C, SIZE(TP$53C));
370   3                   STATTB(02) = STATTB(02) + 1;
371   3                   STATTB(00) = STATTB(00) + 1;
372   3               END;

373   2               CALL SNDSEQ(.TP$51B, SIZE(TP$51B));
374   2               CALL HEX$ASC(CONTROL$CODE, 0);
375   2               CALL SNDSEQ(.TEMP1, 2);
376   2               CALL SNDSEQ(.TP$51C, SIZE(TP$51C));
377   2               CALL HEX$ASC(COUNTRY$CODE, 0);
378   2               CALL SNDSEQ(.TEMP1, 2);
379   2               CALL SNDSEQ(.TP$51A, SIZE(TP$51A));
380   2               CALL HEX$ASC(NETWORK$CODE, 0);
381   2               CALL SNDSEQ(.TEMP1, 2);
382   2               CALL SNDSEQ(.TP$51D, SIZE(TP$51D));
383   2               CALL HEX$ASC(LOBITS, 0);
384   2               CALL SNDSEQ(.TEMP1, 2);
```

```
385  2          CALL SNDSEQ(.TP$51E, SIZE(TP$51E));
386  2          CALL HEX$ASC(HIBITS, 0);
387  2          CALL SNDSEQ(.TEMP1, 2);
388  2          CALL SNDSEQ(.TP$52A, SIZE(TP$52A));
389  2          CALL HEX$ASC(HOST$CODE, 0);
390  2          CALL SNDSEQ(.TEMP1, 2);
391  2          CALL SNDSEQ(.TP$52, SIZE(TP$52));
392  2          CALL HEX$ASC(DESTINATION$ADDRESS, 0);
393  2          CALL SNDSEQ(.TEMP1, 2);

394  2          IF DESTINATION = 6 THEN    /* LOC TO NET, GET SOURCE INFO */
395  2              DO;
396  3              SRC$NET$CODE = LCOXTB(13) AND 0FH;
397  3              IF (SRC$NET$CODE <= MAX$NETWORK$CODE) THEN
398  3                  DO;
399  4                  LOBITS = (ROR(LCOXTB(13), 4) AND 0FH);
400  4                  HIBITS = (ROL(LCOXTB(14), 4) AND 0F0H);
401  4                  SRC$HOST$CODE = LOBITS OR HIBITS;
402  4                  IF (SRC$HOST$CODE >=0) AND (SRC$HOST$CODE <= 63) THEN
403  4                      SOURCE$ADDRESS = SRC$NET$CODE OR 10H;
                        ELSE
404  4                      IF (SRC$HOST$CODE >=64) AND (SRC$HOST$CODE <= 127) THEN
405  4                          SOURCE$ADDRESS = SRC$NET$CODE OR 20H;
                            ELSE
406  4                          IF (SRC$HOST$CODE >= 128) AND (SRC$HOST$CODE <= 191)
                                THEN
407  4                              SOURCE$ADDRESS = SRC$NET$CODE OR 30H;
                                ELSE
408  4                              IF (SRC$HOST$CODE >= 192) AND (SRC$HOST$CODE <=255)
                                    THEN
409  4                                  SOURCE$ADDRESS = SRC$NET$CODE OR 40H;
                        CALL SNDSEQ(.TP$52B, SIZE(TP$52B));
411  4                  CALL HEX$ASC(SOURCE$ADDRESS, 0);
412  4                  CALL SNDSEQ(.TEMP1, 2);
413  4                  END;
                    ELSE
414  3                  DO;
415  4                  DESTINATION = 8;
416  4                  CALL SNDSEQ(.TP$53AA, SIZE(TP$53AA));
417  4                  STATTB(04) = STATTB(04) + 1;
418  4                  STATTB(00) = STATTB(00) + 1;
419  4                  END;

420  3              END;

421  2      END DET$ADDR;

           /*************************************************************************
           PROCEDURE DET$ADDR$NL    DETERMINES THE DESTINATION OF DATA FROM THE NETWORK

           THE PURPOSE OF THIS PROCEDURE IS TO DETERMINE THE DESTINATION OF DATA
```

```
                    COMING FROM THE NETWORK SIDE OF THE UNIT TO A LOCAL HOST.

                INPUT - THE INPUT IS AN ADDRESS VALUE INDICATING THE TABLE LOCATION OF
                    THE DATA TO BE EVALUATED.

                PROCESSING - THE PROCEDURE EXTRACTS THE DESTINATION$ADDRESS FROM THE
                    SECOND BYTE OF THE DATA PACKET AND RETURNS THE CORRESPONDING
                    DESTINATION.

                OUTPUT - THIS PROCEDURE RETURNS THE DESTINATION (1,2,3, OR 4) OF THE
                    DATA COMING FROM THE NETWORK TO A LOCAL HOST.

                INTERFACE - THIS PROCEDURE IS CALLED BY PROCEDURE ROUTE$IN.

                NOTES: 1. BYTE AND 07H WILL MASK OUT THE UPPER 5-BITS.
                ***************************************************************************/

422   1         DET$ADDR$NL: PROCEDURE BYTE ;

425   2             DECLARE  PORT  BYTE,
                           BITS  BYTE;

424   2             BITS = (ROR(NTLCTB(NTLCNS), 4) AND 0FH);
425   2             IF (BITS >= 1 AND BITS <= 4) THEN
426   2                 DO CASE BITS;
427   3                     ;
428   3                     PORT = 1;
429   3                     PORT = 2;
430   3                     PORT = 3;
431   3                     PORT = 4;
432   3                 END;
                      ELSE
455   2                 DO;
454   3                 PORT = 8;
455   3                 STATTB(01) = STATTB(01) + 1;  /*  INCREMENT LOCAL ERROR COUNT  */
456   3             END;
457   2             RETURN PORT;
458   2         END DET$ADDR$NL;

                /***************************************************************************
                PROCEDURE  MOVE$LL   ROUTE OUT EITHER A DATA$PACKET OR HOST DATA

                THE PURPOSE OF THIS PROCEDURE IS TO ROUTE PACKETS FROM THE
                    LOCAL TO LOCAL AND NETWORK TO LOCAL TABLES TO THE CORRECT
                    OUTPUT CHANNEL.

                INPUT - DATA PACKETS ARE ROUTED VIA EVALUATION OF LOLCTB AND
                    NTLCTB ADDRESSS AND INTERNAL PACKET ROUTING INFORMATION
                PROCESSING - THE PROCEDURE CHECKS EACH INPUT BUFFER'S ADDRESSS
                    FOR PACKET ARRIVAL. IF A PACKET IS READY,THE DESTINATION
                    IS DETERMINED VIA PROCEDURE DET$ADDR, AND TRANSMITTED
```

```
                BY SETTING THE TRANSMIT INTERRUPTS THROUGH PROCEDURE
                TRNMIT$PKT. THE TABLE THAT WAS SERVICED (PACKET REMOVED)
                HAS ITS ADDRESSS UPDATED BY SRVC$TAB$HSKP. WHEN THE
                FRAME IS TRANSMITTED TO THE HOSTS FROM THE NET TO LOCAL
                BUFFER TABLE, THE FIRST TWO BYTES OF HEADER INFORMATION
                ARE STRIPPED OFF BEFORE TRANSMISSION.
            OUTPUT - A PACKET OF DATA IS PREPARED FOR TRANSMISSION AND THE
                INTERRUPTS ARE SET.
            INTERFACE - THIS PROCEDURE IS CALLED IN AN INFINITE LOOP BY THE
                MAIN PROGRAM.
            /*************************************************************************/
439   1     MOVE$LL: PROCEDURE(TABLE$PTR, PORT);
440   2         DECLARE PORT BYTE,
                      TABLE$PTR ADDRESS,
                      LOCXTB BASED TABLE$PTR(1) BYTE;

441   2         IF(PORT >= 1 AND PORT <= 4) THEN
442   2             DO CASE PORT;

443   3                 ;     /*   CASE ZERO IS NULL   */

444   3                 DO;    /*   CASE ONE  */
445   4                    IF TRANS$1$RDY = TRUE THEN DO;
447   5                          CALL SNDSEQ(.TP$24, SIZE(TP$24));
448   5                       CALL MOVE(DATA$GRAM$SIZE, TABLE$PTR,.TX01TB(TX01NE));
449   5                       CALL LD$TAB$HSKP(8);
450   5                     END;
451   4                 END;

452   3                 DO;     /*   CASE TWO   */
453   4                    IF TRANS$2$RDY = TRUE THEN DO;
454   5                          CALL SNDSEQ(.TP$25, SIZE(TP$25));
456   5                       CALL MOVE(DATA$GRAM$SIZE, TABLE$PTR, .TX02TB(TX02NE));
457   5                       CALL LD$TAB$HSKP(9);
458   5                     END;
459   4                 END;

460   3                 DO;    /*    CASE THREE    */
461   4                     IF TRANS$3$RDY = TRUE THEN DO;
463   5                          CALL SNDSEQ(.TP$26, SIZE(TP$26));
464   5                       CALL MOVE(DATA$GRAM$SIZE, TABLE$PTR, .TX03TB(TX03NE));
465   5                       CALL LD$TAB$HSKP(10);
466   5                     END;
467   4                 END;

468   3                 DO;      /*    CASE  FOUR    */
469   4                     IF TRANS$4$RDY = TRUE THEN DO;
471   5                          CALL SNDSEQ(.TP$27, SIZE(TP$27));
472   5                       CALL MOVE(DATA$GRAM$SIZE, TABLE$PTR, .TX04TB(TX04NE));
473   5                       CALL LD$TAB$HSKP(11);
474   5                     END;
```

```
475  4              END;

476  3          END;                /* END CASE */
477  2      ELSE DO;
478  3          CALL SNDSEQ(.TP$28, SIZE(TP$28));
479  3          STATTB(L$RO$DEST$ERR) = STATTB(L$RO$DEST$ERR) + 1;
480  3      END;

481  2  END MOVE$LL;

       /*************************************************************************
       PROCEDURE MOVE$NL

           THIS PROCEDURE MOVES A PACKET OF INFORMATION FROM THE NTLCTB INTO ONE
           OF THE FOUR TABLES TO THE HOST.  DESTINATION ADDRESS IS AN INPUT
           PARAMETER TELLING WHICH HOST(PORT) THE PACKET SHOULD BE ROUTED TO.

           CALLED BY ROUTE$IN
       *************************************************************************/
482  1  MOVE$NL: PROCEDURE(PORT);
483  2      DECLARE PORT BYTE;

484  2      IF (PORT >= 1 AND PORT <= 4) THEN
485  2          DO CASE PORT;

486  3              ;

487  3              DO;
488  4                  CALL MOVE(DATA$GRAM$SIZE, .NTLCTB(NTLCNS + 5),
                                                  .TX01TB(TX01NE));
489  4                  CALL SNDSEQ(.TP$30, SIZE(TP$30));
490  4                  CALL LD$TAB$HSKP(8);
491  4              END;

492  3              DO;
493  4                  CALL MOVE(DATA$GRAM$SIZE, .NTLCTB(NTLCNS + 5),
                                                  .TX02TB(TX02NE));
494  4                  CALL SNDSEQ(.TP$31, SIZE(TP$31));
495  4                  CALL LD$TAB$HSKP(9);
496  4              END;

497  3              DO;
498  4                  CALL MOVE(DATA$GRAM$SIZE, .NTLCTB(NTLCNS + 5),
                                                  .TX03TB(TX03NE));
499  4                  CALL SNDSEQ(.TP$32, SIZE(TP$32));
500  4                  CALL LD$TAB$HSKP(10);
501  4              END;

502  3              DO;
503  4                  CALL MOVE(DATA$GRAM$SIZE, .NTLCTB(NTLCNS + 5),
                                                  .TX04TB(TX04NE));
```

```
504   4                    CALL SNDSEQ(.TP$33, SIZE(TP$33));
505   4                    CALL LD$TAB$HSKP(11);
506   4                END;

507   3            END;
               ELSE
508   2            CALL SNDSEQ(.TP$34, SIZE(TP$34));


509   2      END MOVE$NL;

             /*************************************************************
             PROCEDURE   ROUTE$IN    ROUTES IN EITHER DATA$PACKETS OR HOST DATA

             THE PURPOSE OF THIS PROCEDURE IS TO EITHER ROUTE HOST DATA
                  FROM THE FOUR LOCAL INPUT BUFFERS TO THEIR CORRECT OUTPUT
                  BUFFER OR ROUTE DATA$PACKETS FROM THE NETWORK SIDE OF THE UNID
                  TO THEIR CORRECT OUTPUT LOCAL BUFFER MINUS THE DATA$PACKET
                  HEADER.

             INPUT - HOST DATA OR DATA PACKETS ARE ROUTED VIA EVALUATION OF
                  LCXXTB ADDRESSS AND INTERNAL PACKET ROUTING INFORMATION.
             PROCESSENG - THE PROCEDURE CHECKS EACH OF THE LOCAL INPUT BUFFER'S
                  ADDRESSS FOR HOST DATA ARRIVAL. IF ANY HOST DATA IS READY,
                  THE DESTINATION IS DETERMINED VIA PROCEDURE DET$ADDR. ONCE
                  THE DESTINATION IS DETERMINED THEN THE DATA IS EITHER SENT
                  TO A LOCAL BUFFER (LOCAL TO LOCAL TRANSFER) VIA PROCEDURE
                  MOVSEQ OR THE HOST DATA IS CONVERTED INTO A DATA$PACKET
                  (BUILD$I$PACKET) THEN SENT TO THE NETWORK SIDE OF THE UNID
                  VIA MOVSEQ. BOTH THE BUFFER TABLE THAT IS LOADED AND THE
                  TABLE THAT IS SERVICED HAVE THEIR ADDRESSS HOUSECLEANED
                  BY LD$TAB$HSKP AND SRVC$TAB$HSKP.
             OUTPUT - EITHER A DATA$PACKET OR HOST DATA IS MOVED TO AN
                  APPROPRIATE DESTINATION BUFFER.
             INTERFACE - THIS PROCEDURE IS CALLED IN AN ENDLESS LOOP BY THE
                  MAIN PROGRAM
             *************************************************************/
510   1      ROUTE$IN: PROCEDURE;

511   2           IF ((LCOINE - LCOINS) >= DATA$GRAM$SIZE) OR (LCOINS > LCOINE)) THEN
512   2               DO;
513   3               CALL SNDSEQ(.TP$6, SIZE(TP$6));
514   3               CALL DET$ADDR(.LCOITB(LCOINS));
515   3               IF DESTINATION = 5 THEN
516   3                   DO;
517   4                   CALL SNDSEQ(.TP$7, SIZE(TP$7));
518   4                   CALL MOVE$LL(.LCOITB(LCOINS), (ROR(DESTINATION$ADDRESS, 4)
                                                        AND 0FH));
519   4                   END;
                      ELSE
520   3                   IF DESTINATION = 6 THEN
```

```
521   3                    DO;
522   4                    CALL SNDSEQ(.TP$8, SIZE(TP$8));
523   4                    CALL BUILD$I$PACKET(.LC01TB(LC01NS));
524   4                    END;
                         ELSE
525   3                    DO;
526   4                    CALL SNDSEQ(.TP$9, SIZE(TP$9));
527   4                    STATTB(L$RI$DEST$ERR) = STATTB(L$RI$DEST$ERR) + 1;
528   4                    END;
529   3                 CALL SRVC$TAB$HSKP(1);
530   3              END;

531   2              IF(((LC02NE - LC02NS) >= DATA$GRAM$SIZE) OR (LC02NS > LC02NE)) THEN
532   2                 DO;
533   3                 CALL SNDSEQ(.TP$10, SIZE(TP$10));
534   3                 CALL DET$ADDR(.LC02TB(LC02NS));
535   3                 IF DESTINATION = 5 THEN
536   3                    DO;
537   4                    CALL SNDSEQ(.TP$11, SIZE(TP$11));
538   4                    CALL MOVE$LL(.LC02TB(LC02NS), (ROR(DESTINATION$ADDRESS, 4)
                                                          AND 0FH));
539   4                    END;
                         ELSE
540   3                    IF DESTINATION = 6 THEN
541   3                       DO;
542   4                       CALL SNDSEQ(.TP$12, SIZE(TP$12));
543   4                       CALL BUILD$I$PACKET(.LC02TB(LC02NS));
544   4                       END;
                            ELSE
545   3                       DO;
546   4                       CALL SNDSEQ(.TP$13, SIZE(TP$13));
547   4                       CALL SNDSEQ(.TP$51, SIZE(TP$51));
548   4                       CALL HEX$ASC(LOW(DESTINATION),0);
549   4                       CALL SNDSEQ(.TEMP1, 2);
550   4                       CALL SNDSEQ(.TP$52, SIZE(TP$52));
551   4                       CALL HEX$ASC(DESTINATION$ADDRESS,0);
552   4                       CALL SNDSEQ(.TEMP1, 2);
553   4                       STATTB(L$RI$DEST$ERR) = STATTB(L$RI$DEST$ERR) + 1;
554   4                    END;
555   3                 CALL SRVC$TAB$HSKP(2);
556   3              END;

557   2              IF(((LC03NE - LC03NS) >= DATA$GRAM$SIZE) OR (LC03NS > LC03NE)) THEN
558   2                 DO;
559   3                 CALL SNDSEQ(.TP$14, SIZE(TP$14));
560   3                 CALL DET$ADDR(.LC03TB(LC03NS));
561   3                 IF DESTINATION = 5 THEN
562   3                    DO;
563   4                    CALL SNDSEQ(.TP$15, SIZE(TP$15));
564   4                    CALL MOVE$LL(.LC03TB(LC03NS), (ROR(DESTINATION$ADDRESS, 4)
                                                          AND 0FH));
```

```
564   4                 END;
                      ELSE
566   3                 IF DESTINATION = 6 THEN
567   3                    DO;
568   4                    CALL SNDSEQ(.TP$16, SIZE(TP$16));
569   4                    CALL BUILD$I$PACKET(.LC03TB(LC03NS));
570   4                    END;
                       ELSE
571   3                    DO;
572   4                    CALL SNDSEQ(.TP$17, SIZE(TP$17));
573   4                    STATTB(L$RI$DEST$ERR) = STATTB(L$RI$DEST$ERR) + 1;
574   4                 END;
575   3                CALL SRVC$TAB$HSKP(3);
576   3             END;

577   2             IF(((LC04NE - LC04NS) >= DATA$GRAM$SIZE) OR (LC04NS > LC04NE)) THEN
                        DO;
579   3                 CALL SNDSEQ(.TP$18, SIZE(TP$18));
580   3                 CALL DET$ADDR(.LC04TB(LC04NS));
581   3                 IF DESTINATION = 5 THEN
582   3                    DO;
583   4                    CALL SNDSEQ(.TP$19, SIZE(TP$19));
584   4                    CALL MOVE$LL(.LC04TB(LC04NS), (ROR(DESTINATION$ADDRESS, 4)
                                                          AND OFH));
585   4                    END;
                       ELSE
586   3                    IF DESTINATION = 6 THEN
587   3                       DO;
588   4                       CALL SNDSEQ(.TP$20, SIZE(TP$20));
589   4                       CALL BUILD$I$PACKET(.LC04TB(LC04NS));
590   4                       END;
                          ELSE
591   3                       DO;
592   4                       CALL SNDSEQ(.TP$21, SIZE(TP$21));
593   4                       STATTB(L$RI$DEST$ERR) = STATTB(L$RI$DEST$ERR) + 1;
594   4                       END;
595   3                 CALL SRVC$TAB$HSKP(4);
596   3              END,

597   2             IF (NTLCNE - NTLCNS) >= PACKET$SIZE) OR (NTLCNS > NTLCNE) THEN
                        DO;
599   3                 DESTINATION$ADDRESS = DET$ADDR$NL;
600   3                 CALL MOVE$NL(DESTINATION$ADDRESS);
601   3                 CALL SRVC$TAB$HSKP(7);
602   3                 END;

605   2          END ROUTE$IN;

                   /*************************************************************
                   PROCEDURE SERVICE$LOOP
```

```
                PURPOSE
                        TURNS A FRAME AROUND AT THE NETWORK LAYER.  THE SOURCE AND
                    DESTINATION ADDRESSES ARE SWITCHED AND THE PACKET IS PUT INTO THE
                    NETWORK LAYER TABLE.

                INTERFACE
                        CALLED BY MAIN PROGRAM.
                ************************************************************************/
604   1         SERVICE$LOOP: PROCEDURE;
605   2             DECLARE     INDEX   ADDRESS;

606   2             IF ((LCNTNE - LCNTNS) >= PACKET$SIZE) OR
                                    (LCNTNS > LCNTNE) THEN
607   2                 DO;
608   3                 CALL SNDSEQ(.TP$40, SIZE(TP$40));
609   3                 NTLCTB(NTLCNE + 0) = LCNTTB(LCNTNS + 1);
610   3                 NTLCTB(NTLCNE + 1) = LCNTTB(LCNTNS + 0);/*SWAP PACKET HEADER*/
611   3                 DO INDEX = 2 TO (PACKET$SIZE - 1);      /* SWAP DATA */
612   4                     NTLCTB(NTLCNE + INDEX) = LCNTTB(LCNTNS + INDEX);
613   4                 END;
614   3                 DO INDEX = 0 TO 3;                  /* SWAP IP DEST & SOURCE */
615   4                     NTLCTB(NTLCNE + INDEX + 17) = LCNTTB(LCNTNS + INDEX + 21);
616   4                     NTLCTB(NTLCNE + INDEX + 21) = LCNTTB(LCNTNS + INDEX + 17);
617   4                 END;
618   3                 CALL LD$TAB$HSKP(7);
619   3                 CALL SRVC$TAB$HSKP(6);
620   3             END;

621   2         END SERVICE$LOOP;

                /************************************************************************
                PROCEDURE LOAD AND READ$TAB

                    THESE PROCEDURES ARE USED TO PUT A MESSAGE INTO THE LCNTTB TABLE AND
                    WRITE TO THE CRT A MESSAGE IN THE NTLCTB TABLE.
                ************************************************************************/
622   1         LOAD: PROCEDURE(CHAN$PTR, DEST$UNID, DEST$HOST);

623   2             DECLARE (INDEX, CHAN$PTR) ADDRESS;
624   2             DECLARE (DEST$UNID, DEST$HOST) BYTE;
625   2             DECLARE LCOXTB BASED CHAN$PTR(1) BYTE;

626   2                 DO INDEX = 0 TO (DATA$GRAM$SIZE - 1);
627   3                     LCOXTB(INDEX) = '*';
628   3                 END;

                    /* IP SOURCE HEADER */
629   2                 LCOXTB( 12) = 10H;      /* CC    = 1, CT    = 0 */
630   2                 LCOXTB( 13) = (THIS$UNID$NBR AND 0FH) OR
                                    (ROL(LOW(CHAN$NUM*56),4) AND 0F0H);
                                            /* HC(L) = 0, NC    = 2 */
```

```
 26  1      DECLARE     TP$8(*) BYTE DATA(CR,LF,
            'TP$8       Entering forever loop!');

 27  1      DECLARE     MSG1(*) BYTE DATA(CR,LF,
            'Do you want TR/TA handshake (Y/N) [N] ?');
 28  1      DECLARE     MSG2(*) BYTE DATA(CR,LF,
            'Which channel (1, 2, 3, 4) [1] ?');

            /*  THE FOLLOWING DECLARE STATEMENTS SET UP THE TRAP, RST5.5, RST6.5,
            RST7.5 INTERRUPT TABLE IN EPROM TO JUMP TO LOCATIONS IN THE 8155 RAM,
            WHERE ANOTHER JUMP TABLE IS ACCESSABLE BY PROGRAMS IN RAM.  THE RAM
            TABLE IS INITITALIZED TO JMP 0 WHERE THE EPROM ENTRYJUMP IS LOCATED. */

 29  1      DECLARE     JUMP$CODE   LITERALLY '0C3H';
 30  1      DECLARE     VECTOR$TABLE$BASE LITERALLY '7FF4H';

 31  1      DECLARE     VECTOR$TABLE$BASE$PTR ADDRESS,
                         ADDR ADDRESS AT (.VECTOR$TABLE$BASE$PTR),
                         VECTOR$TABLE BASED VECTOR$TABLE$BASE$PTR BYTE;

 32  1      DECLARE     CODE0(3) BYTE AT (0024H) DATA(0C3H,0F4H,7FH),
                         CODE1(3) BYTE AT (002CH) DATA(0C3H,0F7H,7FH),
                         CODE2(3) BYTE AT (0034H) DATA(0C3H,0FAH,7FH),
                         CODE2A(3) BYTE AT (0038H) DATA(0C3H,0,0),
                         CODE3(3) BYTE AT (003CH) DATA(0C3H,0FDH,7FH);

            /*   THIS DECLARE IS NOT CURRENTLY USED BUT MAY BE IN THE FUTURE
            DECLARE
                INT$VECTOR(8)   ADDRESS,    * INTERRUPT VECTORS *
                TRAP$INT        ADDRESS,    * POWER FAIL SENSE *
                INT$75          ADDRESS,    * TIMER INPUTS, TINTO & TINT1 *
                INT$65          ADDRESS,    * RING INDICATOR AND CARRIER DETECT *
                INT$55          ADDRESS,    * FLAG (FINT) AND MULTIBUS INTERRUPT *
                RIM$MASK        BYTE,       * INTERRUPT MASK RETURNED BY RIM *
                TRAP$INT$PTR    LITERALLY   '024H',     * INTERRUPT LOCATIONS *
                INT$55$PTR      LITERALLY   '02CH';
                INT$65$PTR      LITERALLY   '034H',
                INT$75$PTR      LITERALLY   '03CH',
            */

            /************************************************
            *       ISBC 544 I/O DECLARATIONS SECTION       *
            ************************************************/

 33  1      DECLARE                     /* MASTER/SLAVE PORTS */
                SIM$MASK        LITERALLY '01FH',   /* SIM MASK-TURN OFF INTERRUPTS */
                MASTER          LITERALLY '0E5H',   /* MASTER MODE */
                SLAVE           LITERALLY '0E4H';   /* SLAVE MODE */

 34  1      DECLARE                     /* 8251 USARTS */
                US$P0$CMD       LITERALLY '0D3H',   /* SERIAL PORT 0 COMMAND */
```

```
                    DESTINATION$ADDRESS BYTE, /* DESTIN ADDR OF DATAGRAM */
                    SOURCE$ADDRESS BYTE,      /* SOURCE ADDR OF DATAGRAM */
                    FOREVER   BYTE,

                    BRF0        ADDRESS,        /* DATA RATE FACTOR, USART 0 */
                    BRF1        ADDRESS,        /* DATA RATE FACTOR, USART 1 */
                    BRF2        ADDRESS,        /* DATA RATE FACTOR, USART 2 */
                    BRF3        ADDRESS,        /* DATA RATE FACTOR, USART 3 */
                    ISR$STAT    BYTE;           /* IRR STATUS BYTE */

            /*************************************************************************/

 9  1      R$MASK: PROCEDURE BYTE EXTERNAL;    /* USE THE PLM80.LIB WHEN LINKING */
10  2          END R$MASK;                     /* REQUIRED FOR THE 8085 PROCESSOR */

11  1      S$MASK: PROCEDURE (MASK) EXTERNAL;
12  2          DECLARE MASK BYTE;
13  2          END S$MASK;

            /*************************************************************************/

               /* SIGNON MESSAGE AND DIAGNOSTIC MESSAGES */

14  1      DECLARE     HEADER(*) BYTE DATA(CR,LF,
                        '                       UNID II #2 LOCAL OS',CR,LF,
                        '                         TEST PROGRAM',CR,LF,
                        '                       VERS 1.1,  2 OCT 84',CR,LF,
                        '                          EXECUTING ',CR,LF);

15  1      DECLARE     TP$1(*) BYTE DATA(CR,LF,
               'TP$1       Received datagram, putting in LCO1TX');
16  1      DECLARE     TP$2(*) BYTE DATA(CR,LF,
               'TP$2       In ROUTE$OUT');
17  1      DECLARE     TP$3(*) BYTE DATA(CR,LF,
               'TP$3       Sent TR');
18  1      DECLARE     TP$3A(*) BYTE DATA(CR,LF,
               'TP$3A      Sent TA');
19  1      DECLARE     TP$3B(*) BYTE DATA(CR,LF,
               'TP$3B      Received TR');
20  1      DECLARE     TP$3C(*) BYTE DATA(CR,LF,
               'TP$3C      Received TA');
21  1      DECLARE     TP$4(*) BYTE DATA(CR,LF,
               'TP$4       Not TRTA, sending datagram');
22  1      DECLARE     TP$4A(*) BYTE DATA(CR,LF,
               'TP$4A      Completed sending datagram');
23  1      DECLARE     TP$5(*) BYTE DATA(CR,LF,
               'TP$5       Completed initializing 544 board');
24  1      DECLARE     TP$6(*) BYTE DATA(CR,LF,
               'TP$6       Completed initializing variables');
25  1      DECLARE     TP$7(*) BYTE DATA(CR,LF,
               'TP$7       Completed initializing tables');
```

```
                AT (.SYS$BASE + 30 + PACKET$TABLE$SIZE +
                                     PACKET$TABLE$SIZE +
                                     PACKET$TABLE$SIZE +
                                     PACKET$TABLE$SIZE +
                                     FRAME$TABLE$SIZE);

            /*   END OF SHARED MEMORY TABLES AND VARIABLES */

  8   1     DECLARE
                LC01TX (DATA$TABLE$SIZE) BYTE,
                LC02TX (DATA$TABLE$SIZE) BYTE,
                LC03TX (DATA$TABLE$SIZE) BYTE,
                LC04TX (DATA$TABLE$SIZE) BYTE,

                (LC01NS, LC01NE, LC01SZ,
                LC02NS, LC02NE, LC02SZ,
                LC03NS, LC03NE, LC03SZ,
                LC04NS, LC04NE, LC04SZ) ADDRESS,

                (NT01NS, NT01NE, NT01SZ,
                NT02NS, NT02NE, NT02SZ) ADDRESS,

                (TX01NS, TX01NE, TX01SZ,
                TX02NS, TX02NE, TX02SZ,
                TX03NS, TX03NE, TX03SZ,
                TX04NS, TX04NE, TX04SZ) ADDRESS,

                STATTB (STAT$NBR) BYTE,

            /*****************************************************************/
            /*   ADDITIONAL DECLARES NEEDED FOR THIS PROGRAM                 */
            /*****************************************************************/

               /*  INTERNAL VARIABLES USED IN THIS MODULE  */

                (SEND$1, SEND$2, SEND$3, SEND$4) BYTE,

                (BYTES$SENT$1, BYTES$SENT$2,
                BYTES$SENT$3, BYTES$SENT$4) BYTE,

                (BYTES$RECV$1, BYTES$RECV$2,
                BYTES$RECV$3, BYTES$RECV$4) BYTE,

                (TRTA$1,TXTR$1,TXTA$1,RXTR$1,RXTA$1,
                TRTA$2,TXTR$2,TXTA$2,RXTR$2,RXTA$2,
                TRTA$3,TXTR$3,TXTA$3,RXTR$3,RXTA$3,
                TRTA$4,TXTR$4,TXTA$4,RXTR$4,RXTA$4) BYTE,

                (CHAR$1, CHAR$2, CHAR$3, CHAR$4, CHAR$X) BYTE,

                DESTINATION  BYTE,        /* DESTINATION OF THE PACKET */
```

```
            /*  CAUTION: THIS IS THE BEGINNING OF THE SHARED MEMORY AREAS */

            /*  CAUTION: THE FOLLOWING DECLARE STATEMENTS ARE CAREFULLY CHOSEN TO
                 ALLIGN THE UNID LOCAL TRANSMIT, RECEIVE AND NETWORK RECEIVE TABLES
                 AND THE FLAGS AND SEMAPHORES, BEGINNING AT 8001H.  EACH TABLE IS
                 CAREFULLY ALLIGNED SO THAT THEY RESIDE IN CONTIGOUS MEMORY LOCATIONS.
                 ANY CHANGE IN  THESE DECLARE STATEMENTS SHOULD ONLY BE DONE AFTER
                 CAREFULL READING OF THE THESIS BY CHILDRESS, ESPECIALLY CHAPTERS
                 FOUR AND FIVE (4 & 5).  THE ORDER IS ALSO CRITICAL.  THE INITIAL
                 DECLARES FOR THE TABLES MUST BE AT THE CORRECT OFFSET FROM SYS$BASE
                 IN ORDER TO RESIDE IN THE CORRECT LOCATION IN MEMORY.  THE REMAINING
                 LOCAL TRANSMIT TABLES AND OTHER PROGRAM VARIABLES THEN FOLLOW
                 THE SHARED MEMORY AREAS.  SEE THE BATCH FILE USED TO LINK AND LOAD
                 THIS MODULE.
            */

5   1       DECLARE   SYS$MEM$BASE  LITERALLY '08001H';/* SYSTEM MEMORY BASE ADDRESS */

6   1       DECLARE     SYS$BASE    BYTE AT (SYS$MEM$BASE);

                    /* DECLARATIONS FOR FLAGS AND TABLES IN SYSTEM MEMORY */

7   1       DECLARE
                (LSEM$1, LSEM$2, LSEM$3,            /* LOCAL TO NET SEMAPHORE AND */
                LSEM$4, NSEM$1, NSEM$2) BYTE        /* NET TO LOCAL SEMAPHORE */
                    AT (.SYS$BASE),

                (LPTR$1, LSPARE$1, LPTR$2, LSPARE$2,        /* LOC TO NET PACKET PTR */
                LPTR$3, LSPARE$3, LPTR$4, LSPARE$4,         /* LOC TO NET PACKET PTR */
                NPTR$1, NSPARE$1, NPTR$2, NSPARE$2) ADDRESS /* NET TO LOC PACKET PTR */
                    AT (.SYS$BASE + 6),

                LC01RX (PACKET$TABLE$SIZE) BYTE     /* LOCAL BOARD RECEIVE TABLES */
                    AT (.SYS$BASE + 30),
                LC02RX (PACKET$TABLE$SIZE) BYTE
                    AT (.SYS$BASE + 30 + PACKET$TABLE$SIZE),
                LC03RX (PACKET$TABLE$SIZE) BYTE
                    AT (.SYS$BASE + 30 + PACKET$TABLE$SIZE +
                                        PACKET$TABLE$SIZE),
                LC04RX (PACKET$TABLE$SIZE) BYTE
                    AT (.SYS$BASE + 30 + PACKET$TABLE$SIZE +
                                        PACKET$TABLE$SIZE +
                                        PACKET$TABLE$SIZE),

                NT01RX (FRAME$TABLE$SIZE) BYTE      /* NETWORK BOARD RECEIVE TABLES */
                    AT (.SYS$BASE + 30 + PACKET$TABLE$SIZE +
                                        PACKET$TABLE$SIZE +
                                        PACKET$TABLE$SIZE +
                                        PACKET$TABLE$SIZE),
                NT02RX (FRAME$TABLE$SIZE) BYTE
```

```
                    DATA$TABLE$SIZE LITERALLY '1280',/* DATAGRAM * NBR OF
                                                        DATAGRAMS */
                    PACKET$TABLE$SIZE LITERALLY '1330',/* NUMBR OF BYTES IN TABLE*/
                    FRAME$TABLE$SIZE  LITERALLY '1350',/* NUMBR OF BYTES IN TABLE*/
                    TCP$DATA$SIZE  LITERALLY '72',  /* TCP DATA SIZE */
                    TR             LITERALLY '42H', /* TRANSMIT REQUEST CHAR */
                    TA             LITERALLY '41H', /* TRANSMIT ACKNOWLEDGE CHAR */
                    MAX$RXTA$TRIES LITERALLY '3',   /* MAXIMUM NUMBER OF TA WAIT
                                                        TRIES */
                    OFFSET1        LITERALLY '5',     /* OFFSET FROM PACKET TO IP
                                                        HEADER */

                  /* FOLLOWING ARE NETWORK DEFINED VARIABLES */
                  /* NOTES:1. THIS$UNID$NBR MUST REFLECT WHICH UNID THIS IS.
                       2. THIS$COUNTRY$CODE MUST REFLECT THE AREA TO WHICH
                            THIS UNID IS LOCATED.
                       3. MAX$COUNTRY$CODE WILL INDICATE WHICH COUNTRY CODES
                            ARE CURRENTLY OPERATIONAL. CC=0000 IS RESERVED FOR
                            THE DELNET MONITOR.
                       4. MAX$NETWORK$CODE WILL INDICATE HOW MANY UNIDS ARE
                            CURRENTLY OPERATIONAL WITHIN A PARTICULAR COUNTRY.
                       5. FOR DETAILED INFORMATION ON THE ABOVE REFER TO
                            PHISTER'S THESIS, APPENDIX D.  */

                THIS$UNID$NBR    LITERALLY '02',  /* UNIQUE ADDRESS FOR THIS UNID */
                THIS$COUNTRY$CODE LITERALLY '09',/* CC WHERE THIS UNID RESIDES */
                MAX$COUNTRY$CODE LITERALLY '09',/* INDICATES COUNTRY$CODES IN USE */
                MAX$NETWORK$CODE LITERALLY '03';/* INDICATES UNIDS OPERATIONAL
                                                   IN NET */

          /* NOTE: THE LITERAL THIS$COUNTRY$CODE OF 9, ABOVE, IS HERE FOR USE WITH THE
          SUMMER QUARTER EE 6.90 PROJECT;I.E., INTERFACE THE UNID II WITH THE NETOS */

3   1     DECLARE     L$RI$DEST$ERR   LITERALLY '5',   /* LOCAL ROUTE$IN ERROR */
                      L$RO$DEST$ERR   LITERALLY '6';    /* LOCAL ROUTE$OUT ERROR */

                /*  MISCELLANEOUS DECLARATIONS  */

4   1     DECLARE     BUSY        LITERALLY    'OFFH',
                      TRUE        LITERALLY    'OFFH',
                      FALSE       LITERALLY    '00H',
                      READY       LITERALLY    '1',
                      DONE        LITERALLY    '2',
                      CR          LITERALLY    '0DH',
                      LF          LITERALLY    '0AH',
                      USARTON     LITERALLY    '0010$0111B',
                      USARTOFF    LITERALLY    '0000$0110B';

          /*****************************************************************/
          /*    DATA TABLES USED IN THIS PROGRAM                           */
          /*****************************************************************/
```

```
 ISIS-II PL/M-80 V3.0 COMPILATION OF MODULE MAIN
OBJECT MODULE PLACED IN :F1:NEWLOC.OBJ
COMPILER INVOKED BY:  PLM80 :F1:NEWLOC.SRC

            $TITLE('LOCAL NETWORK TEST PROGRAM,  2 OCT 1984')
            $INTVECTOR(4,20H)

            /*****************************************************************/
            /*                                                               */
            /*       DATE:     2 OCT 84                                      */
            /*       VERSION:  1.1                                           */
            /*                                                               */
            /*  TITLE:     LOCAL NETWORK LAYER TEST PROGRAM                  */
            /*  FILE NAME: NEWLOC.SRC                                        */
            /*  OWNER:     C. T. CHILDRESS                                   */
            /*                                                               */
            /*  SOFTWARE SYSTEM:   UNID II                                   */
            /*  USE:       SIMULATE THE FUNCTION OF THE NETWORK LAYER         */
            /*             SOFTWARE FOR USE WITH THE SBC 544                 */
            /*                                                               */
            /*  CONTENTS:  PL/M SOURCE CODE FOR THE UNID II NETWORK          */
            /*             LAYER SOFTWARE.                                   */
            /*                                                               */
            /*****************************************************************/



            /*****************************************************************************
             PROLOGUE - MODULE L.MAIN$U1                    DATE TRANSLATED:  1 SEP 83
                                                          DATE LAST MODIFIED:  2 OCT 84

                *** PURPOSE IS TO SIMULATE THE MAIN 544 CODE USING JUST ONE SET OF
                    TABLES.  THIS PIECE OF S/W WILL WORK WITH THE CP/M SIMULATION
                    IN CPMTMP.SRC
                ***


            *****************************************************************************/

  1         MAIN: DO;

                              /* THE FOLLOWING ARE UNID DEFINED VARIABLES */
                              /* NOTE: THESE VARIABLES MAY CHANGE DEPENDING ON THE
                                       SOFTWARE CONFIGURATION USED WITHIN THE DELNET */

  2   1     DECLARE     DATA$GRAM$SIZE  LITERALLY '128', /* DATAGRAM FROM HOST */
                        PACKET$SIZE     LITERALLY '133', /* DATAGRAM + 5 FOR HEADER */
                        FRAME$SIZE      LITERALLY '135', /* PACKET + 2 FOR HEADER */
                        PACKETS$INSTABLE LITERALLY '10',
                        STAT$NBR        LITERALLY '20', /* STATUS ENTRIES IN STATTB */
```

3. SBC 544 Validation

The purpose of this program is to operate the network level software on the Intel SBC 544. All the constnts, variables and procedures from the network layer simulation are used in this program with the following exceptions:

1. The READ, WRITE, EXIT and ERROR ISIS system calls are not used.
2. The constants R$CONN and W$CONN are not used.
3. The variables ACTUAL, BUFFER, ERRNUM and STATUS are not used.

```
PL/M-80 COMPILER    LOCAL NETWORK TEST PROGRAM, 30 SEP 1984

            /******************************** THE END ********************************/

MODULE INFORMATION:

     CODE AREA SIZE     = 274AH  10058D
     VARIABLE AREA SIZE = 3388H  13240D
     MAXIMUM STACK SIZE = 000CH     12D
     1686 LINES READ
     0 PROGRAM ERROR(S)

END OF PL/M-80 COMPILATION
```

```
847   3          END;

848   2          CALL SNDSEQ(.TP$50, SIZE(TP$50));
849   2          CALL HEX$ASC(LOW(CHAN$NUM), 0);
850   2          CALL SNDSEQ(.TEMP1, 2);
851   2          CALL SNDSEQ(.TP$51A, SIZE(TP$51A));
852   2          CALL HEX$ASC(DEST$NET$CODE, 0);
853   2          CALL SNDSEQ(.TEMP1, 2);
854   2          CALL SNDSEQ(.TP$52A, SIZE(TP$52A));
855   2          CALL HEX$ASC(DEST$HOST$CODE, 0);
856   2          CALL SNDSEQ(.TEMP1, 2);

857   2          CALL SNDSEQ(.MSG2, SIZE(MSG2));
858   2          CALL READ(R$CONN, .BUFFER, 128, .ACTUAL, .STATUS);
859   2          CALL ERR$CHK;

860   2          IF (BUFFER(0) = 'Y') OR (BUFFER(0) = 'y') THEN
861   2              FOREVER = FALSE;
                  ELSE
862   2              FOREVER = TRUE;

863   2      END READ$LINE;

              /*************************************************************************/
              /*     THIS IS THE MAIN BODY OF THE PROGRAM                              */
              /*************************************************************************/

864   1      BEGIN:

             CALL SNDSEQ(.STARTUP$HDR, SIZE(STARTUP$HDR));
865   1        CALL SNDSEQ(.TP$1, SIZE(TP$1));
866   1        CALL INIT$L$TAB;
867   1        CALL SNDSEQ(.TP$2, SIZE(TP$2));
868   1        CALL SNDSEQ(.TP$3, SIZE(TP$3));
869   1        CALL INVINT;
870   1        CALL SNDSEQ(.TP$4, SIZE(TP$4));
871   1        FOREVER = TRUE;
872   1        CALL READ$LINE;
873   1        DO WHILE FOREVER;
874   2             CALL READ$LCTAB;
875   2             CALL SNDSEQ(.TP$5, SIZE(TP$5));
876   2             CALL ROUTE$IN;
877   2             CALL SERVICE$LOOP;
878   2             CALL READ$TXTAB;
879   2             CALL SNDSEQ(.TP$35, SIZE(TP$35));
880   2             CALL READ$LINE;
881   2          END;
882   1          CALL SNDSEQ(.TP$36, SIZE(TP$36));
883   1           CALL EXIT;

884   1      END MAIN;
```

```
                /*************************************************************************
                PROCEDURE READ$LINE

                PURPOSE
                     READS A LINE OF DATA FROM THE HOST ISIS II CONSOLE, THEN INTERPRETED
                     FOR EXECUTING EITHER LOAD ANOTHER TEST MESSAGE IN THE LCNTTB OR
                     STOPPING THE TEST.
                *************************************************************************/
810   1         READ$LINE: PROCEDURE;
811   2             DECLARE CHAN$PTR ADDRESS,
                            (I, DEST$NET$CODE, DEST$HOST$CODE) BYTE;

812   2             I = 0;

813   2             CALL SNDSEQ(.MSG1, SIZE(MSG1));
814   2             CALL READ(R$CONN, .BUFFER, 128, .ACTUAL, .STATUS);
815   2             CALL ERR$CHK;

816   2             IF (BUFFER(0) = 'Y') OR (BUFFER(0) = 'y') THEN
817   2                 DO;
818   3                 CALL SNDSEQ(.MSG3, SIZE(MSG3));
819   3                 CALL READ(R$CONN, .BUFFER, 128, .ACTUAL, .STATUS);
820   3                 CALL ERR$CHK;
821   3                 CHAN$NUM = DOUBLE(ASC$HEX(BUFFER(0)));
822   3                 IF (CHAN$NUM >= 1) AND (CHAN$NUM <= 4) THEN
823   3                     DO;
824   4                     CHAN$PTR = UPDATE$LCPTR(CHAN$NUM);
825   4                     CALL SNDSEQ(.MSG5, SIZE(MSG5));
826   4                     CALL READ(R$CONN, .BUFFER, 128, .ACTUAL, .STATUS);
827   4                     CALL ERR$CHK;
828   4                     DEST$NET$CODE = ASC$HEX(BUFFER(0));

829   4                     CALL SNDSEQ(.MSG6, SIZE(MSG6));
830   4                     CALL READ(R$CONN, .BUFFER, 128, .ACTUAL, .STATUS);
831   4                     CALL ERR$CHK;
832   4                     DEST$HOST$CODE = 0;
833   4                     DO I = 1 TO (ACTUAL-2);
834   5                         DEST$HOST$CODE = ROL(DEST$HOST$CODE, 4);
835   5                         DEST$HOST$CODE = DEST$HOST$CODE OR ASC$HEX(BUFFER(I-1));
836   5                     END;

837   4                     CALL SNDSEQ(.MSG4, SIZE(MSG4));
838   4                     CALL READ(R$CONN, .BUFFER, 128, .ACTUAL, .STATUS);
839   4                     CALL ERR$CHK;
840   4                     IF (BUFFER(0) >= '1') AND (BUFFER(0) <= '9') THEN
841   4                         DO I = 1 TO ASC$HEX(BUFFER(0));
842   5                             CALL LOAD(CHAN$PTR, DEST$NET$CODE, DEST$HOST$CODE);
843   5                             CALL LD$TAB$HSKP(CHAN$NUM);
844   5                             CHAN$PTR = UPDATE$LCPTR(CHAN$NUM);
845   5                         END;
846   4                 END;
```

```
766   4                   I = I + 1;
767   4               END;
768   3               I = 0;
769   3               DO WHILE I <= 15;
770   4                   TEMP2(I) = TEMP1(14-I);
771   4                   TEMP2(I+1) = TEMP1(15-I);
772   4                   I = I + 2;
773   4               END;
774   3               CALL SNDSEQ(.TP$56C, SIZE(TP$56C));
775   3               CALL SNDSEQ(.CRLF, SIZE(CRLF));
776   3               CALL SNDSEQ(.TEMP2, SIZE(TEMP2));
777   3               CALL SNDSEQ(.LC03TB(LC03NS + 56), TCP$DATA$SIZE);
778   3           END;

779   2           IF ((LC04NE - LC04NS) >= DATA$GRAM$SIZE) OR (LC04NS > LC04NE) THEN
780   2               DO;
781   3               I = 12;
782   3               DO WHILE I <= 18;
783   4                   CALL HEX$ASC(LC04TB(LC04NS + I),(I-12)*2);
784   4                   I = I + 1;
785   4               END;
786   3               I = 0;
787   3               DO WHILE I <= 15;
788   4                   TEMP2(I) = TEMP1(14-I);
789   4                   TEMP2(I+1) = TEMP1(15-I);
790   4                   I = I + 2;
791   4               END;
792   3               CALL SNDSEQ(.TP$56D, SIZE(TP$56D));
793   3               CALL SNDSEQ(.CRLF, SIZE(CRLF));
794   3               CALL SNDSEQ(.TEMP2, SIZE(TEMP2));
795   3               CALL SNDSEQ(.LC04TB(LC04NS + 56), TCP$DATA$SIZE);
796   3           END;

797   2       END READ$LCTAB;

798   1       UPDATE$LCPTR: PROCEDURE(CHAN$NUM) ADDRESS;
799   2           DECLARE (CHAN$NUM, CHAN$PTR) ADDRESS;

800   2           IF (CHAN$NUM >= 1 AND CHAN$NUM <= 4) THEN
801   2               DO CASE CHAN$NUM;
802   3                   ;
803   3                   CHAN$PTR = .LC01TB(LC01NE);
804   3                   CHAN$PTR = .LC02TB(LC02NE);
805   3                   CHAN$PTR = .LC03TB(LC03NE);
806   3                   CHAN$PTR = .LC04TB(LC04NE);
807   3               END;

808   2           RETURN CHAN$PTR;

809   2       END UPDATE$LCPTR;
```

```
720  3                CALL SRVC$TAB$HSKP(11);
721  3            END;

722  2     END READ$TXTAB;

723  1     READ$LCTAB: PROCEDURE;
724  2         DECLARE I BYTE;

725  2             IF ((LC01NE - LC01NS) >= DATA$GRAM$SIZE) OR (LC01NS > LC01NE) THEN
726  2                 DO;
727  3                 I = 12;
728  3                 DO WHILE I <= 18;
729  4                     CALL HEX$ASC(LC01TB(LC01NS + I),(I-12)*2);
730  4                     I = I + 1;
731  4                 END;
732  3                 I = 0;
733  3                 DO WHILE I <= 15;
734  4                     TEMP2(I) = TEMP1(14-I);
735  4                     TEMP2(I+1) = TEMP1(15-I);
736  4                     I = I + 2;
737  4                 END;
738  3                 CALL SNDSEQ(.TP$56A, SIZE(TP$56A));
739  3                 CALL SNDSEQ(.CRLF, SIZE(CRLF));
740  3                 CALL SNDSEQ(.TEMP2, SIZE(TEMP2));
741  3                 CALL SNDSEQ(.LC01TB(LC01NS + 56), TCP$DATA$SIZE);
742  3             END;

743  2             IF ((LC02NE - LC02NS) >= DATA$GRAM$SIZE) OR (LC02NS > LC02NE) THEN
744  2                 DO;
745  3                 I = 12;
746  3                 DO WHILE I <= 18;
747  4                     CALL HEX$ASC(LC02TB(LC02NS + I),(I-12)*2);
748  4                     I = I + 1;
749  4                 END;
750  3                 I = 0;
751  3                 DO WHILE I <= 15;
752  4                     TEMP2(I) = TEMP1(14-I);
753  4                     TEMP2(I+1) = TEMP1(15-I);
754  4                     I = I + 2;
755  4                 END;
756  3                 CALL SNDSEQ(.TP$56B, SIZE(TP$56B));
757  3                 CALL SNDSEQ(.CRLF, SIZE(CRLF));
758  3                 CALL SNDSEQ(.TEMP2, SIZE(TEMP2));
759  3                 CALL SNDSEQ(.LC02TB(LC02NS + 56), TCP$DATA$SIZE);
760  3             END;

761  2             IF ((LC03NE - LC03NS) >= DATA$GRAM$SIZE) OR (LC03NS > LC03NE) THEN
762  2                 DO;
763  3                 I = 12;
764  3                 DO WHILE I <= 18;
765  4                     CALL HEX$ASC(LC03TB(LC03NS + I),(I-12)*2);
```

```
671  4                  END;
672  3                  I = 0;
673  3                  DO WHILE I <= 15;
674  4                      TEMP2(I) = TEMP1(14-I);
675  4                      TEMP2(I+1) = TEMP1(15-I);
676  4                      I = I + 2;
677  4                  END;
678  3                  CALL SNDSEQ(.TP$55B, SIZE(TP$55B));
679  3                  CALL SNDSEQ(.CRLF, SIZE(CRLF));
680  3                  CALL SNDSEQ(.TEMP2, SIZE(TEMP2));
681  3                  CALL SNDSEQ(.TX02TB(TX02NS + 56), TCP$DATA$SIZE);
682  3                  CALL SRVC$TAB$HSKP(9);
683  3              END;

684  2              IF ((TX03NE - TX03NS) >= DATA$GRAM$SIZE) OR (TX03NS > TX03NE) THEN
685  2                  DO;
686  3                  I = 12;
687  3                  DO WHILE I <= 18;
688  4                      CALL HEX$ASC(TX03TB(TX03NS + I),(I-12)*2);
689  4                      I = I + 1;
690  4                  END;
691  3                  I = 0;
692  3                  DO WHILE I <= 15;
693  4                      TEMP2(I) = TEMP1(14-I);
694  4                      TEMP2(I+1) = TEMP1(15-I);
695  4                      I = I + 2;
696  4                  END;
697  3                  CALL SNDSEQ(.TP$55C, SIZE(TP$55C));
698  3                  CALL SNDSEQ(.CRLF, SIZE(CRLF));
699  3                  CALL SNDSEQ(.TEMP2, SIZE(TEMP2));
700  3                  CALL SNDSEQ(.TX03TB(TX03NS + 56), TCP$DATA$SIZE);
701  3                  CALL SRVC$TAB$HSKP(10);
702  3              END;

703  2              IF ((TX04NE - TX04NS) >= DATA$GRAM$SIZE) OR (TX04NS > TX04NE) THEN
704  2                  DO;
705  3                  I = 12;
706  3                  DO WHILE I <= 18;
707  4                      CALL HEX$ASC(TX04TB(TX04NS + I),(I-12)*2);
708  4                      I = I + 1;
709  4                  END;
710  3                  I = 0;
711  3                  DO WHILE I <= 15;
712  4                      TEMP2(I) = TEMP1(14-I);
713  4                      TEMP2(I+1) = TEMP1(15-I);
714  4                      I = I + 2;
715  4                  END;
716  3                  CALL SNDSEQ(.TP$55D, SIZE(TP$55D));
717  3                  CALL SNDSEQ(.CRLF, SIZE(CRLF));
718  3                  CALL SNDSEQ(.TEMP2, SIZE(TEMP2));
719  3                  CALL SNDSEQ(.TX04TB(TX04NS + 56), TCP$DATA$SIZE);
```

```
631  2            LCOXTB( 14) = 70H OR (ROR(LOW(CHAN$NUM*56),4) AND 0FH);
                                        /* PC(0) = 7, HC(H) = 0 */
632  2            LCOXTB( 15) = 00H;     /* PC(2) = 0, PC(1) = 0 */

                /* IP DESTINATION HEADER */
633  2            LCOXTB( 16) = 10H;     /* CC    = 1, CT    = 0 */
634  2            LCOXTB( 17) = (DEST$UNID AND 0FH) OR
                                ROL((DEST$HOST AND 0FH), 4);
                                        /* HC(L) = 6, NC    = 2 */
635  2            LCOXTB( 18) = ROR((DEST$HOST AND 0F0H),4) OR 70H;
                                        /* PC(0) = 7, HC(H) = 0 */
636  2            LCOXTB( 19) = 00H;     /* PC(2) = 0, PC(1) = 0 */

637  2            CALL MOVE(TCP$DATA$SIZE, .MESSAGE, .LCOXTB( 56));
638  2            IF MSGNUM > 9 THEN
639  2                MSGNUM = 0;
640  2            LCOXTB( 86) = '0' + MSGNUM;
641  2            MSGNUM = MSGNUM + 1;
642  2            CALL SNDSEQ(.TP$54, SIZE(TP$54));

643  2      END LOAD;

644  1      READ$TXTAB: PROCEDURE;
645  2          DECLARE I BYTE;

646  2            IF ((TX01NE - TX01NS) >= DATA$GRAM$SIZE) OR (TX01NS > TX01NE) THEN
647  2                DO;
648  3                I = 12;
649  3                DO WHILE I <= 18;
650  4                    CALL HEX$ASC(TX01TB(TX01NS + I),(I-12)*2);
651  4                    I = I + 1;
652  4                END;
653  3                I = 0;
654  3                DO WHILE I <= 15;
655  4                    TEMP2(I) = TEMP1(14-I);
656  4                    TEMP2(I+1) = TEMP1(15-I);
657  4                    I = I + 2;
658  4                END;
659  3                CALL SNDSEQ(.TP$55A, SIZE(TP$55A));
660  3                CALL SNDSEQ(.CRLF, SIZE(CRLF));
661  3                CALL SNDSEQ(.TEMP2, SIZE(TEMP2));
662  3                CALL SNDSEQ(.TX01TB(TX01NS + 56), TCP$DATA$SIZE);
663  3                CALL SRVC$TAB$HSKP(8);
664  3            END;

665  2            IF ((TX02NE - TX02NS) >= DATA$GRAM$SIZE) OR (TX02NS > TX02NE) THEN
666  2                DO;
667  3                I = 12;
668  3                DO WHILE I <= 18;
669  4                    CALL HEX$ASC(TX02TB(TX02NS + I),(I-12)*2);
670  4                    I = I + 1;
```

```
                US$P0$STAT      LITERALLY '0D1H',   /* SERIAL PORT 0 STATUS */
                US$P0$DATA      LITERALLY '0D0H',   /* SERIAL PORT 0 DATA */
                US$P1$CMD       LITERALLY '0D3H',   /* SERIAL PORT 1 COMMAND */
                US$P1$STAT      LITERALLY '0D3H',   /* SERIAL PORT 1 STATUS */
                US$P1$DATA      LITERALLY '0D2H',   /* SERIAL PORT 1 DATA */
                US$P2$CMD       LITERALLY '0D5H',   /* SERIAL PORT 2 COMMAND */
                US$P2$STAT      LITERALLY '0D5H',   /* SERIAL PORT 2 STATUS */
                US$P2$DATA      LITERALLY '0D4H',   /* SERIAL PORT 2 DATA */
                US$P3$CMD       LITERALLY '0D7H',   /* SERIAL PORT 3 COMMAND */
                US$P3$STAT      LITERALLY '0D7H',   /* SERIAL PORT 3 STATUS */
                US$P3$DATA      LITERALLY '0D6H',   /* SERIAL PORT 3 DATA */
                US$MODE         LITERALLY '04EH',   /* SERIAL PORT MODE */
                US$COMMAND      LITERALLY '027H',   /* SERIAL PORT COMMAND */

                US$RESET$CMD    LITERALLY '40H',    /* RESET USART */
                US$DTR$ON       LITERALLY '27H',    /* RTS,RXE,DTR,TXE */
                US$CRT$CMD      LITERALLY '37H',    /* RTS,ER,RXE,DTR,TXE */
                US$TTY$CMD      LITERALLY '35H',    /* RTS,ER,RXE,TXE */
                US$DTR$OFF      LITERALLY '25H',    /* RTS,RXE,TXE */
                US$RXRDY        LITERALLY '02H',    /* RECIEVER READY */
                US$TXE          LITERALLY '04H',    /* TRANSMITTER EMPTY */
                US$TXRDY        LITERALLY '01H',    /* TRANSMITTER READY */
                PARITY$MASK     LITERALLY '7FH';    /* MASK OFF PARITY BIT */

35  1       DECLARE                     /* 8253 INTERVAL TIMER */
                IT1$CONT    LITERALLY 'ODBH',   /* INTERVAL TIMER 1 CONTROL */
                IT1$CNTR0   LITERALLY 'OD8H',   /* COUNTER 0, USART 0 */
                IT1$CNTR1   LITERALLY 'OD9H',   /* COUNTER 1, USART 1 */
                IT1$CNTR2   LITERALLY 'ODAH',   /* COUNTER 2, USART 2 */
                IT2$CONT    LITERALLY 'ODFH',   /* INTERVAL TIMER 2 CONTROL */
                IT2$CNTR0   LITERALLY 'ODCH',   /* COUNTER 3, USART 3 */
                IT2$CNTR1   LITERALLY 'ODDH',   /* COUNTER 4, CNTR5 OR SPLIT CLOCKS */
                IT2$CNTR2   LITERALLY 'ODEH',   /* COUNTER 5, RST 7.5 */
                USART$CNTR$M3 LITERALLY '036H', /* DIVIDE BY N RATE GENERATOR, MODE 3,*/
                                            /* FOR USART CLK x 16, CLK = 1.2288 MHZ */

                B19200      LITERALLY '4',      /* TIMER VALUE FOR 19.2 KBPS */
                B9600       LITERALLY '8',      /* TIMER VALUE FOR 9600 BPS */
                B4800       LITERALLY '16',     /* TIMER VALUE FOR 4800 BPS */
                B2400       LITERALLY '32',     /* TIMER VALUE FOR 2400 BPS */
                B1200       LITERALLY '64',     /* TIMER VALUE FOR 1200 BPS */
                B600        LITERALLY '128',    /* TIMER VALUE FOR 600 BPS */
                B300        LITERALLY '256',    /* TIMER VALUE FOR 300 BPS */
                B150        LITERALLY '512',    /* TIMER VALUE FOR 150 BPS */
                B110        LITERALLY '698';    /* TIMER VALUE FOR 110 BPS */

35  1       DECLARE                     /*8155 PERIPHERAL INTERFACE*/
                PI$PORTA    LITERALLY 'OE9H',   /* PORT A (OUTPUT) */
                PI$PORTB    LITERALLY 'OEAH',   /* PORT B (INPUT) */
                PI$PORTC    LITERALLY 'OEBH',   /* PORT C (INPUT) */
                PI$STAT     LITERALLY 'OE8H',   /* PPI STATUS */
```

```
            PI$CMD      LITERALLY '0E8H',   /* PPI COMMAND */
            PI$CNTR$LO  LITERALLY '0ECH',   /* PPI COUNTER LO BYTE */
            PI$CNTR$HI  LITERALLY '0EDH',   /* PPI COUNTER HI BYTE */
            PI$CNTR$LOCNT LITERALLY '16384', /* PPI COUNTER TIME CONST */
            PI$CNTR$HICNT LITERALLY '75',   /* PPI COUNTER TIME CONST */
            PI$INIT$CMD1  LITERALLY '041H', /* PPI INITIALIZATION COMMAND 1 */
                                            /* A OUT, B & C IN, STOP COUNT */
            PI$INIT$CMD2  LITERALLY '0C1H', /* PPI INITIALIZATION COMMAND 2 */
                                            /* A OUT, B & C IN, START COUNT */
            PI$INIT$US$INT1 LITERALLY '0F0H', /* USART AND INT CONT RESET */
            PI$INIT$US$INT2 LITERALLY '0C0H', /* USART AND INT CONT NORMAL */


            PI$PORTC$STAT   LITERALLY '0CCH',   /*PORT C STATUS*/
            PI$PORTC$CTL    LITERALLY '0CEH',   /*PORT C CONTROL*/
            PI$M2M1     LITERALLY '0C6H',   /*A-MODE 1, B-MODE 2*/
            PI$OBF      LITERALLY '080H',   /*OUTPUT BUFFER READY*/
            PI$IBF      LITERALLY '02H';    /*INPUT BUFFER READY'*/


37  1       DECLARE                     /*8259 INTERRUPT CONTROLLER*/
                IC$PORTA    LITERALLY '0E6H',   /* PORT A */
                IC$PORTB    LITERALLY '0E7H',   /* PORT B */
                IC$ICW1     LITERALLY '56H',    /* INIT COMMAND WORD 1,
                                                (A7A6A5) = 010; EDGE TRIG;
                                                INTERVAL = 4; SINGLE; NO ICW4 */
                IC$ICW2     LITERALLY '00H',    /* INIT COMMAND WORD 2,
                                                (A15-A8) = 0 */
                IC$ICW3     LITERALLY '00H',    /* INIT COMMAND WORD 3,
                                                NO SLAVE IN IR */
                IC$ICW4     LITERALLY '0CH',    /* INIT COMMAND WORD 4, NOT USED */
                IC$MASK     LITERALLY '0',      /* INTERRUPT MASK, OCW1, NOT USED;
                                                0 = ALL INTERRUPTS ENABELLED */
                INIT$MASK   LITERALLY '10101010B',
                                                /* INITIAL INTERRUPT MASK, OCW1;
                                                RECEIVE INTR ON, TRANSMIT INTR OFF */
                IC$EOI      LITERALLY '0A0H',   /* END OF INTERRUPT CMD, OCW2,
                                                ROTATE (PRIORITY) ON NON-SPECIFIC EOI */
                IC$OCW3IR   LITERALLY '0AH',    /* READ IRR LEVEL, OCW3,
                                                NO SPECIAL MASK MODE; NO POLL;
                                                READ IR REG (NOT USED) */
                IC$OCW3IS   LITERALLY '0BH',    /* READ ISR LEVEL, OCW3,
                                                NO SPECIAL MASK MODE; NO POLL;
                                                READ IS REG (NOT USED) */
                IC$OCW3$SMMS LITERALLY '60H',   /* SPECIAL MASK MODE SET */
                IC$OCW3$SMMR LITERALLY '40H';   /* SPECIAL MASK MODE RESET */

            /*************************************************************************/
            /*                                                                       */
            /* PROCEDURE    INITIALIZE$BOARD     INITIALIZES THE HARDWARE PORTS      */
            /*                                                                       */
```

```
                /*  THE PURPOSE OF THIS PROCEDURE IS TO INITIALIZE ALL THE HARDWARE     */
                /*      PORTS, TO INCLUDE THE PARALLEL PORTS, THE CLOCK/TIMERS, THE     */
                /*      INTERRUPT CONTROLLER, AND THE FOUR USARTS.  PORT 0 IS USED TO   */
                /*      COMMUNICATE WITH AN EXTERNAL TERMINAL.  PORTS 1, 2, AND 3 ARE  */
                /*      USED TO COMMUNICATE WITH EXTERNAL HOSTS.                        */
                /*                                                                      */
                /*  INPUT - NONE                                                        */
                /*  PROCESSING - SETS THE VECTOR INTERRUPT TABLE VALUES AND WRITES THE   */
                /*      CONTROL WORD TO THE PIC, PIT, PPI, AND USARTS.                  */
                /*  OUTPUT - NONE                                                       */
                /*  INTERFACE - CALLED BY MAIN PROGRAM.                                 */
                /*                                                                      */
                /************************************************************************/

                /*  INITIALIZE 8155 PROGRAMMABLE PERIPHERAL INTERFACE (PPI)  */
                /*  SET DATA RATES FOR LOCAL CHANNEL USARTS:                 */
                /*      SET PIT #1, REGISTER #0 FOR USART #0 DATA RATE       */
                /*      SET PIT #1, REGISTER #1 FOR USART #1 DATA RATE       */
                /*      SET PIT #1, REGISTER #2 FOR USART #2 DATA RATE       */
                /*      SET PIT #2, REGISTER #0 FOR USART #3 DATA RATE       */
                /*  INITIATE RESET ON ALL USARTS                             */
                /*  INITIALIZE THE FOUR USARTS TO: 2 STOP BITS, NO PARITY,   */
                /*     8 BIT CHARACTERS, AND 16X DATA RATE                   */
                /*  INITIALIZE THE  8259 PROGRAMMABLE INTERRUPT CONTROLLER   */

                /************************************
                * DEVICE INITIALIZATION SECTION     *
                ************************************/

38   1      INITIALIZE$BOARD:
                /* THIS PROCEDURE INITIALIZES THE ISBC 544 BOARD */
                PROCEDURE;

39   2      PI$INIT:        /* 8155 PARALLEL INTERFACE INITIALIZATION */
                OUTPUT(PI$CMD) = PI$INIT$CMD1;
40   2          OUTPUT(PI$PORTA) = PI$INIT$US$INT1; /* RESETS THE 8251 USARTS */
41   2          OUTPUT(PI$PORTA) = PI$INIT$US$INT2;
42   2          OUTPUT(PI$CNTR$LO) = PI$CNTR$LOCNT;
43   2          OUTPUT(PI$CNTR$HI) = PI$CNTR$HICNT;
44   2          OUTPUT(PI$CMD) = PI$INIT$CMD2;

45   2      IT$INIT:        /* 8253 INTERVAL TIMER INITIALIZATION */
                BRF0 = B9600;
46   2          BRF1 = B9600;
47   2          BRF2 = B9600;
48   2          BRF3 = B9600;
49   2          OUTPUT(IT1$CONT) = USART$CNTR$M3;           /* USART 0 */
50   2          OUTPUT(IT1$CNTR0) = LOW(BRF0);
51   2          OUTPUT(IT1$CNTR0) = HIGH(BRF0);
52   2          OUTPUT(IT1$CONT) = 40H OR USART$CNTR$M3;    /* USART 1 */
53   2          OUTPUT(IT1$CNTR1) = LOW(BRF1);
```

```
 54   2          OUTPUT(IT1$CNTR1) = HIGH(BRF1);
 55   2          OUTPUT(IT1$CONT) = 80H OR USART$CNTR$M3;    /* USART 2 */
 56   2          OUTPUT(IT1$CNTR2) = LOW(BRF2);
 57   2          OUTPUT(IT1$CNTR2) = HIGH(BRF2);
 58   2          OUTPUT(IT2$CONT) = USART$CNTR$M3;           /* USART 3 */
 59   2          OUTPUT(IT2$CNTR0) = LOW(BRF3);
 60   2          OUTPUT(IT2$CNTR0) = HIGH(BRF3);

 61   2      IC$INIT:        /* 8259 INTERRUPT CONTROLLER INITIALIZATION */

              /*THE FOLLOWING CODE INITIALIZES THE 8259A. THE INTERRUPTS ARE
              USED FOR THIS PROGRAM. ALL INTERRUPTS ARE ON EXCEPT FOR THE RST TYPES */

              OUTPUT(IC$PORTA) = IC$ICW1;
 62   2          OUTPUT(IC$PORTB) = IC$ICW2;
 63   2          OUTPUT(IC$PORTB) = INIT$MASK;   /* OCW1 */
 64   2          OUTPUT(IC$PORTA) = IC$EOI;      /* OCW2 */
 65   2          OUTPUT(IC$PORTA) = IC$OCW3IS;   /* OCW3 */
 66   2          ISR$STAT = INPUT(IC$PORTA);

 67   2      US$INIT:        /* INITIALIZE THE USARTS */
                              /* ASYNC MODE, 8 DATA BITS, 1 STOP BIT, NO PARITY, x16 CLOCK
                                 DTR, RTS ON, RECV ON, TRANSMIT OFF                    */
              OUTPUT(US$P0$CMD) = US$MODE;
 68   2          OUTPUT(US$P0$CMD) = USARTON;
 69   2          OUTPUT(US$P1$CMD) = US$MODE;
 70   2          OUTPUT(US$P1$CMD) = USARTON;
 71   2          OUTPUT(US$P2$CMD) = US$MODE;
 72   2          OUTPUT(US$P2$CMD) = USARTON;
 73   2          OUTPUT(US$P3$CMD) = US$MODE;
 74   2          OUTPUT(US$P3$CMD) = USARTON;

 75   2      END INITIALIZE$BOARD;

              /*************************************************************************
              PROCEDURE INIT     INITIALIZES THE TABLE POINTERS AND VARIABLES

              PURPOSE OF THIS PROCEDURE IS TO INITIALIZE THE INTERRUPT JUMP TABLE, AND
                   OTHER DATA TABLE VARIABLES AND BOOLEAN FLAGS

              INPUT - NONE

              PROCESSING - THE INTERRUPT JUMP TABLE IS INITIALLIZED ALONG WITH THE DATA
                   TABLE AND BOOLEAN FLAG VARIABLES

              OUTPUT - INITIALIZED INTERRUPT TABLE AND DATA TABLE VARIABLES

              INTERFACE - CALLED BY MAIN PROCEDURE

              *************************************************************************/
 76   1      INIT: PROCEDURE;
```

```
 77  2          DECLARE I BYTE;

             /* THE FOLLOWING CODE INITIALIZES THE JUMP TABLE IN 8155 RAM TO POINT
             TO THE USER'S INTERRUPT SERVICE ROUTINES AT INTR$VECTOR$5$5, ETC.     */

             /*  ADDR = .INTR$VECTOR$5$5;
                 VECTOR$TABLE = JUMP$CODE;
                 ADDR = ADDR + 1;
                 VECTOR$TABLE = LOW(VECTOR$TABLE$BASE);
                 ADDR = ADDR + 1;
                 VECTOR$TABLE = HIGH(VECTOR$TABLE$BASE);

                 ADDR = .INTR$VECTOR$6$5;
                 VECTOR$TABLE = JUMP$CODE;
                 ADDR = ADDR + 1;
                 VECTOR$TABLE = LOW(VECTOR$TABLE$BASE + 3);
                 ADDR = ADDR + 1;
                 VECTOR$TABLE = HIGH(VECTOR$TABLE$BASE + 3);

                 ADDR = .INTR$VECTOR$7$5;
                 VECTOR$TABLE = JUMP$CODE;
                 ADDR = ADDR + 1;
                 VECTOR$TABLE = LOW(VECTOR$TABLE$BASE + 6);
                 ADDR = ADDR + 1;
                 VECTOR$TABLE = HIGH(VECTOR$TABLE$BASE + 6);
             */

             /* INITIALIZES 8155 JUMP TABLE TO JMP 0 */

 78  2          I = 0;
 79  2          ADDR = VECTOR$TABLE$BASE;       /* = 7FF4H */
 80  2          DO WHILE I <= 11;
 81  3              VECTOR$TABLE = JUMP$CODE;
 82  3              ADDR = ADDR + 1;
 83  3              VECTOR$TABLE = 0;
 84  3              ADDR = ADDR + 1;
 85  3              VECTOR$TABLE = 0;
 86  3              ADDR = ADDR + 1;
 87  3              I = I + 3;
 88  3          END;

 89  2          BYTES$SENT$1 = 0;
 90  2          BYTES$SENT$2 = 0;
 91  2          BYTES$SENT$3 = 0;
 92  2          BYTES$SENT$4 = 0;

 93  2          BYTES$RECV$1 = 0;
 94  2          BYTES$RECV$2 = 0;
 95  2          BYTES$RECV$3 = 0;
 96  2          BYTES$RECV$4 = 0;
```

```
 97   2          SEND$1 = FALSE;
 98   2          SEND$2 = FALSE;
 99   2          SEND$3 = FALSE;
100   2          SEND$4 = FALSE;

101   2          TRTA$1,TXTR$1,TXTA$1,RXTR$1,RXTA$1 = FALSE;
102   2          TRTA$2,TXTR$2,TXTA$2,RXTR$2,RXTA$2 = FALSE;
103   2          TRTA$3,TXTR$3,TXTA$3,RXTR$3,RXTA$3 = FALSE;
104   2          TRTA$4,TXTR$4,TXTA$4,RXTR$4,RXTA$4 = FALSE;

105   2          CHAR$1 = '1';
106   2          CHAR$2 = '2';
107   2          CHAR$3 = '3';
108   2          CHAR$4 = '4';
109   2          CHAR$X = 'X';

110   2      END INIT;

              /*************************************************************************/
              /*  PROCEDURE  INIT$TAB  INITIALIZES THE LOCAL TABLES AND PROGRAM        */
              /*                       VARIABLES                                       */
              /*                                                                       */
              /*   THIS PROCEDURE SETS THE LOCAL AND NETWORK TABLES TO THEIR           */
              /*        INITIAL VALUES PRIOR TO PROCESSING ANY MESSAGES. IN ADDITION,  */
              /*        THE PROGRAM VARIABLES ARE SET TO THEIR INITIAL VALUES.         */
              /*                                                                       */
              /*   INPUTS - NONE                                                       */
              /*                                                                       */
              /*   PROCESSING - PUTS INITIAL VALUES IN THE LOCAL TABLES                */
              /*                                                                       */
              /*   OUTPUT - NONE                                                       */
              /*                                                                       */
              /*   INTERFACE - CALLED BY THE MAIN PROCEDURE                            */
              /*                                                                       */
              /*************************************************************************/

111   1      INIT$TAB: PROCEDURE;
112   2          DECLARE  IX  BYTE;

113   2          LSEM$1 = DONE;  /* INITIALIZATION OF THE SEMAPHORE FLAGS */
114   2          LSEM$2 = DONE;
115   2          LSEM$3 = DONE;
116   2          LSEM$4 = DONE;

117   2          NSEM$1 = DONE;
118   2          NSEM$2 = DONE;

119   2          LSPARE$1 = 0;   /* THE SPARE ADDRESS LOCATIONS SHOULD BE SET TO THE  */
120   2          LSPARE$2 = 0;   /* SEGMENT NUMBER INTO WHICH THE LOCAL BOARD MEMORY  */
121   2          LSPARE$3 = 0;   /* WILL BE MAPPED INTO SYSTEM MEMORY. THIS VALUE IS  */
122   2          LSPARE$4 = 0;   /* CURRENTLY 0 FOR THE LSPARE$X VARIABLES.           */
```

```
123   2          NSPARE$1 = 0;   /* SAME AS FOR LSPARE$X DISCUSSION ABOVE          */
124   2          NSPARE$2 = 0;

125   2          LPTR$1 = 0;
126   2          LPTR$2 = 0;
127   2          LPTR$3 = 0;
128   2          LPTR$4 = 0;

129   2          NPTR$1 = 0;
130   2          NPTR$2 = 0;

131   2          NTO1NS = 0;
132   2          NTO1NE = 0;
133   2          NTO1SZ = FRAME$TABLE$SIZE;

134   2          NTO2NS = 0;
135   2          NTO2NE = 0;
136   2          NTO2SZ = FRAME$TABLE$SIZE;

137   2          LCO1NS = 0;
138   2          LCO1NE = 0;
139   2          LCO1SZ = PACKET$TABLE$SIZE;

140   2          LCO2NS = 0;
141   2          LCO2NE = 0;
142   2          LCO2SZ = PACKET$TABLE$SIZE;

143   2          LCO3NS = 0;
144   2          LCO3NE = 0;
145   2          LCO3SZ = PACKET$TABLE$SIZE;

146   2          LCO4NS = 0;
147   2          LCO4NE = 0;
148   2          LCO4SZ = PACKET$TABLE$SIZE;

149   2          TXO1NS = 0;
150   2          TXO1NE = 0;
151   2          TXO1SZ = DATA$TABLE$SIZE;

152   2          TXO2NS = 0;
153   2          TXO2NE = 0;
154   2          TXO2SZ = DATA$TABLE$SIZE;

155   2          TXO3NS = 0;
156   2          TXO3NE = 0;
157   2          TXO3SZ = DATA$TABLE$SIZE;

158   2          TXO4NS = 0;
159   2          TXO4NE = 0;
160   2          TXO4SZ = DATA$TABLE$SIZE;
```

```
161   2          IX = 0;
162   2          DO WHILE IX < STAT$NBR;
163   3              STATTB(IX) = 0;
164   3              IX = IX + 1;
165   3          END;

166   2      END INIT$TAB;

              /*************************************************************************/
              /*  PROCEDURE   SNDSEQ   SENDS DATA TO LOCAL MONITOR FOR TESTING         */
              /*                                                                       */
              /*   THIS PROCEDURE TAKES A MESSAGE STRING AND OUTPUTS IT TO             */
              /*        THE LOCAL MONITOR ATTACHED TO PORT 0 OF THE 544 BOARD          */
              /*                                                                       */
              /*   INPUT - A POINTER TO THE MESSAGE LOCATION IN MEMORY AND THE         */
              /*        NUMBER OF BYTES TO BE SENT.                                    */
              /*   PROCESSING - THIS PROCEDURE CHECKS THE OUTPUT BUFFER STATUS         */
              /*        IN A LOOP UNTIL THE BUFFER IS EMPTY. IT PLACES ONE             */
              /*        BYTE AT A TIME IN THE OUTPUT USART UNTIL THE MESSAGE           */
              /*        IS DONE.                                                       */
              /*   OUTPUT - MESSAGE TO THE USART 0 PORT.                               */
              /*   INTERFACE - THIS PROCEDURE IS CALLED BY VARIOUS PROCEDURES.         */
              /*                                                                       */
              /*************************************************************************/

167   1      SNDSEQ: PROCEDURE(MSG, TOTAL);
168   2              DECLARE  MSG  ADDRESS,
                      CHAROUT BASED MSG(1) BYTE;
169   2              DECLARE  (COUNT, TOTAL) BYTE;

170   2              COUNT = 0;
171   2      LOOP:   DO WHILE COUNT < TOTAL;
172   3                  DO WHILE NOT (INPUT(US$PO$STAT) AND 1); END;
174   3                  OUTPUT(US$PO$DATA) = CHAROUT(COUNT);
175   3                  COUNT = COUNT + 1;
176   3              END LOOP;

177   2      END SNDSEQ;

              /*************************************************************************
              PROCEDURE  LD$TAB$HSKP     LOAD TABLE HOUSEKEEP

              THE PURPOSE OF THIS PROCEDURE IS TO HOUSEKEEP A SPECIFIED BUFFER
                   TABLE AFTER LOADING OF THE USER DATA FROM THE HOST.

              INPUT - THE INPUT IS A BYTE INDICATING THE TABLE REQUIRING
                   CHANGES.

              PROCESSING - THE PROCEDURE DETERMINES THE TABLE TO BE PROCESSED,
                   ADVANCES THE NEXT$EMPTY$BYTE ADDRESS BY ONE PACKET, DATAGRAM,
```

```
                OR FRAME AND ADJUSTS FOR BUFFER WRAP IF NECESSARY.

              OUTPUT - THE SPECIFIED TABLE HAS ITS NEXT$EMPTY$BYTE ADDRESS
                   ADVANCED BY THE LENGTH OF A SINGLE PACKET, DATAGRAM OR FRAME.

              INTERFACE - THIS PROCEDURE IS CALLED BY PROCEDURE VARIOUS PROCEDURES.

              ************************************************************************/
178   1       LD$TAB$HSKP: PROCEDURE(TABLE) ;
179   2           DECLARE  TABLE BYTE;

180   2           IF (TABLE >=1 AND TABLE <= 10) THEN /* 8 FOR REAL, 10 FOR SIM */
181   2               DO CASE TABLE;

182   3                   ;                       /* CASE ZERO IS NULL */

                          /* CASES 1, 2, 3, 4 FOR LC01(2,3,4) ARE NOT REQUIRED AS */
                          /* THE LCOXNS POINTERS ARE INCREMENTED AND CHECKED IN THE */
                          /* RECEIVE DATAGRAM INTERRUPT ROUTINES. USE FOR SIMULATION */
                          /* PURPOSES ONLY. CASE 9 IS FOR SIMULATION ONLY         */

183   3                   DO;
184   4                     LC01NE = LC01NE + PACKET$SIZE;
185   4                     IF LC01NE >= LC01SZ THEN
186   4                        LC01NE = 0;
187   4                   END;

188   3                   DO;
189   4                     LC02NE = LC02NE + PACKET$SIZE;
190   4                     IF LC02NE >= LC02SZ THEN
191   4                        LC02NE = 0;
192   4                   END;

193   3                   DO;
194   4                     LC03NE = LC03NE + PACKET$SIZE;
195   4                     IF LC03NE >= LC03SZ THEN
196   4                        LC03NE = 0;
197   4                   END;

198   3                   DO;
199   4                     LC04NE = LC04NE + PACKET$SIZE;
200   4                     IF LC04NE >= LC04SZ THEN
201   4                        LC04NE = 0;
202   4                   END;

203   3                   DO;
204   4                     TX01NE = TX01NE + DATA$GRAM$SIZE;
205   4                     IF TX01NE >= TX01SZ THEN
206   4                         TX01NE = 0;
207   4                   END;
```

```
208   3                 DO;
209   4                   TX02NE = TX02NE + DATA$GRAM$SIZE;
210   4                   IF TX02NE >= TX02SZ THEN
211   4                       TX02NE = 0;
212   4                 END;

213   3                 DO;
214   4                   TX03NE = TX03NE + DATA$GRAM$SIZE;
215   4                   IF TX03NE >= TX03SZ THEN
216   4                       TX03NE = 0;
217   4                 END;

218   3                 DO;
219   4                   TX04NE = TX04NE + DATA$GRAM$SIZE;
220   4                   IF TX04NE >= TX04SZ THEN
221   4                       TX04NE = 0;
222   4                 END;

223   3                 DO;
224   4                   NT01NE = NT01NE + FRAME$SIZE;
225   4                   IF NT01NE >= NT01SZ THEN
226   4                       NT01NE = 0;
227   4                 END;

228   3                 DO;
229   4                   NT02NE = NT02NE + FRAME$SIZE;
230   4                   IF NT02NE >= NT02SZ THEN
231   4                       NT02NE = 0;
232   4                 END;

233   3               END;

                      ELSE
234   2                DO;
235   3                   STATTB(7) = STATTB(7) + 1;
236   3                   STATTB(0) = STATTB(0) + 1;
237   3                END;

238   2       END LD$TAB$HSKP;

                /*************************************************************************
                PROCEDURE   SRVC$TAB$HSKP       SERVICE TABLE HOUSEKEEP

                THE PURPOSE OF THIS PROCEDURE IS TO HOUSEKEEP A SPECIFIED
                     BUFFER TABLE AFTER SERVICING (REMOVING A PACKET).

                INPUT - THE INPUT IS A BYTE VALUE INDICATING THE TABLE THAT
                     REQUIRES HOUSEKEEPING.

                PROCESSING - THE PROCEDURE DETERMINES THE TABLE TO BE PROCESSED,
                     ADVANCES THE NEXT$BYTE$TO$BE$SERVICED ADDRESS BY A PACKET, DATAGRAM,
```

```
                    OR A FRAME AND ADJUSTS FOR BUFFER WRAP IF NECESSARY.

                  OUTPUT - THE SPECIFIED TABLE HAS ITS NEXT$BYTE$TO$BE$SERVICED ADDRESS
                       ADVANCED BY THE LENGTH OF A SINGLE PACKET, DATAGRAM OR FRAME.

                  INTERFACE - THIS PROCEDURE IS CALLED BY PROCEDURE ROUTE$IN AND ROUTE$OUT.

                  ************************************************************************/

239   1     SRVC$TAB$HSKP: PROCEDURE(TABLE) ;
240   2         DECLARE  TABLE  BYTE;

241   2         IF (TABLE >= 1 AND TABLE <= 10) THEN    /* 8 FOR REAL, 10 FOR SIM */
242   2             DO CASE TABLE;

243   3                 ;                 /*  CASE ZERO IS NULL  */

244   3                 DO;
245   4                   LC01NS = LC01NS + PACKET$SIZE;
246   4                   IF LC01NS >= LC01SZ THEN
247   4                      LC01NS = 0;
248   4                 END;

249   3                 DO;
250   4                   LC02NS = LC02NS + PACKET$SIZE;
251   4                   IF LC02NS >= LC02SZ THEN
252   4                      LC02NS = 0;
253   4                 END;

254   3                 DO;
255   4                   LC03NS = LC03NS + PACKET$SIZE;
256   4                   IF LC03NS >= LC03SZ THEN
257   4                      LC03NS = 0;
258   4                 END;

259   3                 DO;
260   4                   LC04NS = LC04NS + PACKET$SIZE;
261   4                   IF LC04NS >= LC04SZ THEN
262   4                      LC04NS = 0;
263   4                 END;

                        /* CASES 5, 6, 7, 8 FOR TX01(2,3,4) ARE NOT REQUIRED AS */
                        /* THE TXOXNS POINTERS ARE INCREMENTED AND CHECKED IN THE */
                        /* TRANSMIT DATAGRAM INTERRUPT ROUTINES. USE FOR SIMULATION */
                        /* PURPOSES ONLY. CASE 9 IS FOR SIMULATION ONLY          */

264   3                 DO;
265   4                   TX01NS = TX01NS + DATA$GRAM$SIZE;
266   4                   IF TX01NS >= TX01SZ THEN
267   4                       TX01NS = 0;
268   4                 END;
```

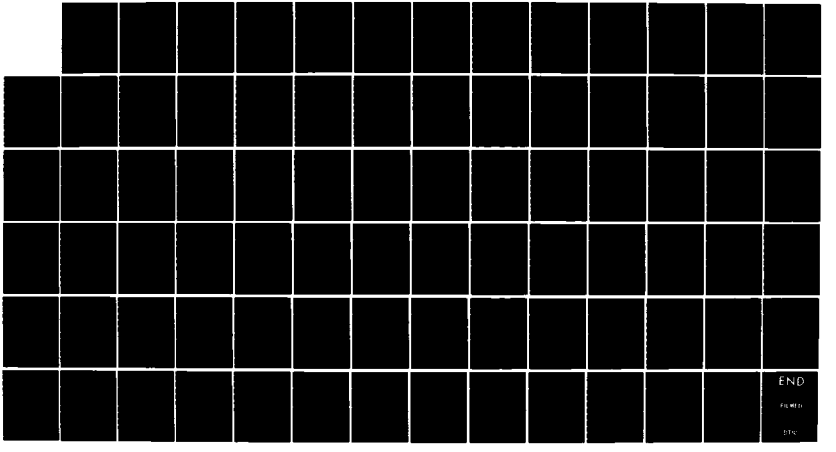
```
269   3                 DO;
270   4                   TX02NS = TX02NS + DATA$GRAM$SIZE;
271   4                   IF TX02NS >= TX02SZ THEN
272   4                       TX02NS = 0;
273   4                 END;

274   3                 DO;
275   4                   TX03NS = TX03NS + DATA$GRAM$SIZE;
276   4                   IF TX03NS >= TX03SZ THEN
277   4                       TX03NS = 0;
278   4                 END;

279   3                 DO;
280   4                   TX04NS = TX04NS + DATA$GRAM$SIZE;
281   4                   IF TX04NS >= TX04SZ THEN
282   4                       TX04NS = 0;
283   4                 END;

284   3                 DO;
285   4                   NT01NS = NT01NS + FRAME$SIZE;
286   4                   IF NT01NS >= NT01SZ THEN
287   4                       NT01NS = 0;
288   4                 END;

289   3                 DO;
290   4                   NT02NS = NT02NS + FRAME$SIZE;
291   4                   IF NT02NS >= NT02SZ THEN
292   4                       NT02NS = 0;
293   4                 END;

294   3               END;

                      ELSE
295   2                   DO;
296   3                       STATTB(8) = STATTB(8) + 1;
297   3                       STATTB(0) = STATTB(0) + 1;
298   3                   END;

299   2         END SRVC$TAB$HSKP;

                /*************************************************************************/
                /*  INCLUDES THE INTERRUPT DRIVER ROUTINES FROM A SEPARATE FILE          */
                /*************************************************************************/

                $ INCLUDE(INTR.LOC)

                /*************************************************************************
                PROCEDURE RXIN$1     RECEIVES DATA FROM PORT ONE OF FOUR ON THE SBC 544

                PURPOSE OF THIS PROCEDURE IS TO RECEIVE A CHARACTER FROM THE SBC TERMINAL
```

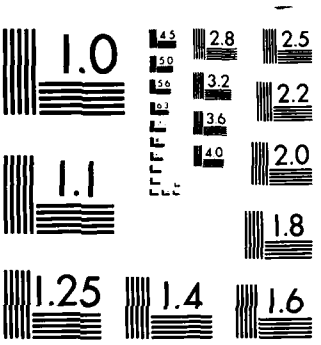
```
                INPUT - INTERRUPT FROM THE TERMINAL

                PROCESSING - THE RECEIVED CHARACTER IS INPUT FROM USART 0 AND ECHOED
                     BACK TO THE TERMINAL.  THE RECEIVE INTERRUPT IS CLEARED.

                OUTPUT - THE RECEIVED CHARACTER IS PUT INTO THE CHAR$X VARIABLE.

                INTERFACE - CALLED BY READ$LINE PROCEDURE

                ************************************************************************/
          =
300    1  =   RXIN$1: PROCEDURE INTERRUPT 8;
          =
301    2  =       CHAR$X = INPUT(US$PO$DATA);
302    2  =       OUTPUT(US$PO$DATA) = CHAR$X;
303    2  =       OUTPUT(IC$PORTA)   = IC$EOI;
          =
304    2  =   END RXIN$1;
          =
                /************************************************************************
                PROCEDURE TXOUT$1   A DUMMY INTERRUPT STUB

                PURPOSE OF THIS PROCEDURE IS TO PROVIDE A DUMMY STUB FOR THE TERMINAL
                     INTERRUPT HANDLER.

                INPUT - INTERRUPT FOR THE TERMINAL TRANSMIT

                PROCESSING - CLEAR THE TRANSMIT INTERRUPT

                OUTPUT - CLEARED INTERRUPT

                INTERFACE - NONE

                ************************************************************************/

305    1  =   TXOUT$1: PROCEDURE INTERRUPT 9;
306    2  =       OUTPUT(IC$PORTA)   = IC$EOI;
307    2  =   END TXOUT$1;
          =
          =   /************************************************************************/
          =   /*                                                                      */
          =   /*  PROCEDURE  SERVICE$RCV$1   RECEIVES DATA ONE CHANNEL ONE            */
          =   /*                                                                      */
          =   /*   THE PURPOSE OF THIS PROCEDURE IS TO TAKE A RECEIVED CHARACTER      */
          =   /*        FROM THE RECEIVE PORT ONE AND PUT IT IN THE RECEIVE ONE       */
          =   /*        BUFFER.  THE TRTA FLAGS ARE CHECKED FOR USE AND THE TRTA      */
          =   /*        SET ACCORDINGLY.  THIS ROUTINE IS TOTALLY INTERRUPT DRIVEN    */
          =   /*        AND OPERATES CONTINUALLY AFTER INITIALIZATION.                */
          =   /*                                                                      */
          =   /*   INPUT - INTERRUPT ON USART 1                                       */
```

```
          =   /*                                                              */
          =   /*   PROCESSING - MOVES A BYTE OF DATA FROM THE RECEIVE USART TO  */
          =   /*        MEMORY.  THE TRTA FLAGS ARE CHECKED AND APPROPRIATELY SET.*/
          =   /*                                                              */
          =   /*   OUTPUT - RECEIVED CHARACTER AND APPROPRIATELY SET TRTA FLAGS.*/
          =   /*                                                              */
          =   /*   INTERFACE - INTERRUPTS SET DURING INITIALIZATION.           */
          =   /*        *  ACTIVATED BY USART 1   *                           */
          =   /*                                                              */
          =   /*   NOTE: THE SAME PROCEDURE IS USED FOR USARTS 2 AND 3 WITH APPROPRIATE*/
          =   /*        MODIFICATIONS OF THE VARIABLE NAMES.                  */
          =   /*************************************************************/
          =
308   1   =   SERVICE$RCV$2: PROCEDURE INTERRUPT 10;
          =
309   2   =       CHAR$2 = INPUT(US$PI$DATA);
          =
310   2   =       IF ((NOT TRTA$2) OR ((RXTR$2 AND TXTA$2) AND
          =                   ((NOT TXTR$2) AND (NOT RXTA$2)))) THEN
311   2   =           DO;
312   3   =           LCO2RX(LCO2NE + 5) = CHAR$2;
313   3   =           BYTES$RECV$2 = BYTES$RECV$2 + 1;
314   3   =           LCO2NE = LCO2NE + 1;
315   3   =           IF BYTES$RECV$2 >= DATA$GRAM$SIZE THEN
316   3   =               DO;
317   4   =               LCO2NE = LCO2NE + 5;
318   4   =               IF(LCO2NE >= LCO2SZ) THEN
319   4   =                   LCO2NE = 0;
320   4   =               BYTES$RECV$2 = 0;
321   4   =               RXTR$2 = FALSE;
322   4   =               TXTA$2 = FALSE;
323   4   =               SEND$2 = FALSE;
324   4   =               END;
325   3   =           END;
          =
326   2   =       IF TRTA$2 THEN
327   2   =           DO;
328   3   =           IF CHAR$2 = TA THEN
329   3   =               IF ((TXTR$2 AND (NOT RXTA$2)) AND
          =                       ((NOT RXTR$2) AND (NOT TXTA$2))) THEN
330   3   =                   DO;
331   4   =                   RXTA$2 = TRUE;
332   4   =                   SEND$2 = FALSE;
333   4   =                   CALL SNDSEQ(.TP$3C, SIZE(TP$3C));
334   4   =                   END;
335   3   =           IF CHAR$2 = TR THEN
336   3   =               IF (((NOT RXTR$2) AND (NOT TXTA$2)) AND
          =                       ((NOT TXTR$2) AND (NOT RXTA$2))) THEN
337   3   =                   DO;
338   4   =                   RXTR$2 = TRUE;
339   4   =                   TXTA$2 = TRUE;
```

AD-A151 947 CONTINUED DEVELOPMENT AND IMPLEMENTATION OF THE UNIVERSAL NETWORK INTERFA..(U) AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OH SCHOOL OF ENGI.. C T CHILDRESS 2/2

UNCLASSIFIED DEC 84 AFIT/GE/ENG/84D-17-VOL-2 F/G 17/2 NL





```
 340   4  =                  SEND$2 = TRUE;
 341   4  =                  CALL SNDSEQ(.TP$3B, SIZE(TP$3B));
 342   4  =                  CALL SNDSEQ(.TP$3A, SIZE(TP$3A));
 343   4  =                  OUTPUT(US$P1$DATA) = TA;
 344   4  =                  END;
 345   3  =              END;
          =
 346   2  =          OUTPUT(IC$PORTA) = IC$EOI;
          =
 347   2  =      END SERVICE$RCV$2;
          =
          =
/*************************************************************************/
          =
 348   1  =      SERVICE$RCV$3: PROCEDURE INTERRUPT 12;
          =
 349   2  =          CHAR$3 = INPUT(US$P2$DATA);
          =
 350   2  =          IF ((NOT TRTA$3) OR ((RXTR$3 AND TXTA$3) AND
          =                      ((NOT TXTR$3) AND (NOT RXTA$3)))) THEN
 351   2  =              DO;
 352   3  =              LC03RX(LC03NE + 5) = CHAR$3;
 353   3  =              BYTES$RECV$3 = BYTES$RECV$3 + 1;
 354   3  =              LC03NE = LC03NE + 1;
 355   3  =              IF BYTES$RECV$3 >= DATA$GRAM$SIZE THEN
 356   3  =                  DO;
 357   4  =                  LC03NE = LC03NE + 5;
 358   4  =                  IF(LC03NE >= LC03SZ) THEN
 359   4  =                      LC03NE = 0;
 360   4  =                  BYTES$RECV$3 = 0;
 361   4  =                  RXTR$3 = FALSE;
 362   4  =                  TXTA$3 = FALSE;
 363   4  =                  SEND$3 = FALSE;
 364   4  =                  END;
 365   3  =              END;
          =
 366   2  =          IF TRTA$3 THEN
 367   2  =              DO;
 368   3  =              IF CHAR$3 = TA THEN
 369   3  =                  IF ((TXTR$3 AND (NOT RXTA$3)) AND
          =                          ((NOT RXTR$3) AND (NOT TXTA$3))) THEN
 370   3  =                      DO:
 371   4  =                      RXTA$3 = TRUE;
 372   4  =                      SEND$3 = FALSE;
 373   4  =                      CALL SNDSEQ(.TP$3C, SIZE(TP$3C));
 374   4  =                      END;
 375   3  =              IF CHAR$3 = TR THEN
 376   3  =                  IF (((NOT RXTR$3) AND (NOT TXTA$3)) AND
          =                          ((NOT TXTR$3) AND (NOT RXTA$3))) THEN
 377   3  =                      DO;
 378   4  =                      RXTR$3 = TRUE;
```

```
379   4  =                  TXTA$3 = TRUE;
380   4  =                  SEND$3 = TRUE;
381   4  =                  CALL SNDSEQ(.TP$3B, SIZE(TP$3B));
382   4  =                  CALL SNDSEQ(.TP$3A, SIZE(TP$3A));
383   4  =                  OUTPUT(US$P2$DATA) = TA;
384   4  =                  END;
385   3  =              END;
         =
386   2  =          OUTPUT(IC$PORTA) = IC$EOI;
         =
387   2  =      END SERVICE$RCV$3;
         =
         =
                /*************************************************************************/
         =
388   1  =      SERVICE$RCV$4: PROCEDURE INTERRUPT 14;
         =
389   2  =          CHAR$4 = INPUT(US$P3$DATA);
         =
390   2  =          IF ((NOT TRTA$4) OR ((RXTR$4 AND TXTA$4) AND
         =                      ((NOT TXTR$4) AND (NOT RXTA$4)))) THEN
391   2  =              DO;
392   3  =              LC04RX(LC04NE + 5) = CHAR$4;
393   3  =              BYTES$RECV$4 = BYTES$RECV$4 + 1;
394   3  =              LC04NE = LC04NE + 1;
395   3  =              IF BYTES$RECV$4 >= DATA$GRAM$SIZE THEN
396   3  =                  DO;
397   4  =                  LC04NE = LC04NE + 5;
398   4  =                  IF(LC04NE >= LC04SZ) THEN
399   4  =                      LC04NE = 0;
400   4  =                  BYTES$RECV$4 = 0;
401   4  =                  RXTR$4 = FALSE;
402   4  =                  TXTA$4 = FALSE;
403   4  =                  SEND$4 = FALSE;
404   4  =                  END;
405   3  =              END;
         =
406   2  =          IF TRTA$4 THEN
407   2  =              DO;
408   3  =              IF CHAR$4 = TA THEN
409   3  =                  IF ((TXTR$4 AND (NOT RXTA$4)) AND
         =                          ((NOT RXTR$4) AND (NOT TXTA$4))) THEN
410   3  =                      DO;
411   4  =                      RXTA$4 = TRUE;
412   4  =                      SEND$4 = FALSE;
413   4  =                      CALL SNDSEQ(.TP$3C, SIZE(TP$3C));
414   4  =                      END;
415   3  =              IF CHAR$4 = TR THEN
416   3  =                  IF (((NOT RXTR$4) AND (NOT TXTA$4)) AND
         =                          ((NOT TXTR$4) AND (NOT RXTA$4))) THEN
417   3  =                      DO;
```

```
418   4  =                  RXTR$4 = TRUE;
419   4  =                  TXTA$4 = TRUE;
420   4  =                  SEND$4 = TRUE;
421   4  =                  CALL SNDSEQ(.TP$3B, SIZE(TP$3B));
422   4  =                  CALL SNDSEQ(.TP$3A, SIZE(TP$3A));
423   4  =                  OUTPUT(US$P3$DATA) = TA;
424   4  =                  END;
425   3  =          END;
         =
426   2  =      OUTPUT(IC$PORTA) = IC$EOI;
         =
427   2  =  END SERVICE$RCV$4;
         =
         =  /*****************************************************************/
         =  /*  PROCEDURE   SERVICE$TRANS$1   SENDS DATA OUT CHANNEL ONE     */
         =  /*                                                               */
         =  /*   THE PURPOSE OF THIS PROCEDURE IS TO SEND A DATAGRAM OF DATA OUT */
         =  /*        LOCAL CHANNEL ONE. A SINGLE BYTE IS TRANSMITTED EACH TIME AN */
         =  /*        INTERRUPT IS GENERATED BY USART ONE ON THE TRANSMIT SIDE.  */
         =  /*                                                               */
         =  /*   INPUT - INTERRUPT MASKED ON BY CALLING PROCEDURE            */
         =  /*                                                               */
         =  /*   PROCESSING - SENDS A BYTE OF DATA FROM THE TRANSMIT ARRAY TO */
         =  /*        THE DATA PORT.       WHEN MESSAGE IS DONE IT RESETS     */
         =  /*        THE TRANSMIT INTERRUPT AND SETS TRANS$1$RDY TO TRUE.    */
         =  /*                                                               */
         =  /*   OUTPUT - CHARACTER OUTPUT USART 1                           */
         =  /*                                                               */
         =  /*   INTERFACE - CALLED BY                                       */
         =  /*                                                               */
         =  /*   NOTE: THE SAME PROCEDURE IS USED FOR USARTS 2 AND 3 WITH APPROPRIATE*/
         =  /*        MODIFICATIONS OF THE VARIABLE NAMES.                   */
         =  /*****************************************************************/
         =
429   1  =  SERVICE$TRANS$2: PROCEDURE INTERRUPT 11;
         =
429   2  =      IF ((NOT TRTA$2) OR ((TXTR$2 AND RXTA$2) AND
         =             ((NOT RXTR$2) AND (NOT TXTA$2)))) THEN
430   2  =          DO;
431   3  =          OUTPUT(US$P1$DATA) = LOO2TX(TX02NS);
432   3  =          BYTES$SENT$2 = BYTES$SENT$2 + 1;
433   3  =          TX02NS = TX02NS + 1;
434   3  =          IF BYTES$SENT$2 >= DATA$GRAM$SIZE THEN
435   3  =              DO;
436   4  =              OUTPUT(IC$PORTB) = INPUT(IC$PORTB) OR 8;
437   4  =              BYTES$SENT$2 = 0;
438   4  =              IF TX02NS >= TX02S.' THEN
439   4  =                  TX02NS = 0;
440   4  =              TXTR$2 = FALSE;
441   4  =              RXTA$2 = FALSE;
442   4  =              SEND$2 = FALSE;
```

```
 443   4  =              CALL SNDSEQ(.TP$4A, SIZE(TP$4A));
 444   4  =              END;
 445   3  =          END;
            =
 446   2  =      OUTPUT(IC$PORTA) = IC$EOI;
            =
 447   2  =  END SERVICE$TRANS$2;
            =
            =
                /*************************************************************************/
            =
 448   1  =  SERVICE$TRANS$3: PROCEDURE INTERRUPT 13;
            =
 449   2  =      IF ((NOT TRTA$3) OR ((TXTR$3 AND RXTA$3) AND
            =              ((NOT RXTR$3) AND (NOT TXTA$3)))) THEN
 450   2  =          DO;
 451   3  =          OUTPUT(US$P2$DATA) = LC03TX(TX03NS);
 452   3  =          BYTES$SENT$3 = BYTES$SENT$3 + 1;
 453   3  =          TX03NS = TX03NS + 1;
 454   3  =          IF BYTES$SENT$3 >= DATA$GRAM$SIZE THEN
 455   3  =              DO;
 456   4  =              OUTPUT(IC$PORTB) = INPUT(IC$PORTB) OR 20H;
 457   4  =              BYTES$SENT$3 = 0;
 458   4  =              IF TX03NS >= TX03SZ THEN
 459   4  =                  TX03NS = 0;
 460   4  =              TXTR$3 = FALSE;
 461   4  =              RXTA$3 = FALSE;
 462   4  =              SEND$3 = FALSE;
 463   4  =              CALL SNDSEQ(.TP$4A, SIZE(TP$4A));
 464   4  =              END;
 465   3  =          END;
            =
 466   2  =      OUTPUT(IC$PORTA) = IC$EOI;
            =
 467   2  =  END SERVICE$TRANS$3;
            =
            =
                /*************************************************************************/
            =
 468   1  =  SERVICE$TRANS$4: PROCEDURE INTERRUPT 15;
            =
 469   2  =      IF ((NOT TRTA$4) OR ((TXTR$4 AND RXTA$4) AND
            =              ((NOT RXTR$4) AND (NOT TXTA$4)))) THEN
 470   2  =          DO;
 471   3  =          OUTPUT(US$P3$DATA) = LC04TX(TX04NS);
 472   3  =          BYTES$SENT$4 = BYTES$SENT$4 + 1;
 473   3  =          TX04NS = TX04NS + 1;
 474   3  =          IF BYTES$SENT$4 >= DATA$GRAM$SIZE THEN
 475   3  =              DO;
 476   4  =              OUTPUT(IC$PORTB) = INPUT(IC$PORTB) OR 80H;
 477   4  =              BYTES$SENT$4 = 0;
```

```
478   4  =              IF TX04NS >= TX04SZ THEN
479   4  =                 TX04NS = 0;
480   4  =              TXTR$4 = FALSE;
481   4  =              RXTA$4 = FALSE;
482   4  =              SEND$4 = FALSE;
483   4  =              CALL SNDSEQ(.TP$4A, SIZE(TP$4A));
484   4  =              END;
485   3  =           END;
         =
486   2  =       OUTPUT(IC$PORTA) = IC$EOI;
         =
487   2  =   END SERVICE$TRANS$4;
         =
         =
```

```
/*************************************************************************/
/* PROCEDURE  SEND$PACKET  PROCEDURE FOR TRANSFORMING THE USER DATAGRAM  */
/*                         INTO A PACKET FOR TRANSFER INTO THE NETWORK   */
/*                         SIDE OF THE UNID.                             */
/*                                                                       */
/*   THE PURPOSE OF THIS PROCEDURE IS TO TRANSFORM THE HOST'S            */
/*        DATAGRAM  DELIVERED TO ONE OF THE LOCAL INPUT BUFFERS INTO A   */
/*        PACKET AND UPDATE THE POINTERS AND SEMAPHORES.                 */
/*        THE PROCEDURE ADDS THE FIVE HEADER BYTES, AS FOLLOWS:          */
/*            1.  1 BYTE FOR THE DESTINATION ADDRESS.                    */
/*            2.  1 BYTE FOR THE SOURCE ADDRESS.                         */
/*            3.  1 BYTE FOR THE SEQUENCE NUMBER.                        */
/*            4.  1 BYTE FOR A SPARE  (SPARE$01).                        */
/*            5.  1 BYTE FOR A SPARE  (SPARE$02).                        */
/*                                                                       */
/*   INPUT - THIS PROCEDURE RECEIVES A  POINTER THAT INDICATES THE       */
/*        LOCAL INPUT BUFFER WHERE THE INCOMING HOST DATA IS             */
/*        LOCATED AND A VARIABLE THAT INDICATES FROM WHICH PORT THE      */
/*        DATA CAME.                                                     */
/*                                                                       */
/*   PROCESSING - THE PROCEDURE BEGINS WITH THE PASSING OF THE TABLE     */
/*        WHERE THE HOST'S DATA IS LOCATED. THE SOURCE AND               */
/*        DESTINATION ADDRESS (SOURCE$ADDRESS, DESTINATION$ADDRESS)      */
/*        ARE SUPPLIED BY THE DET$ADDR PROCEDURE. FOR NOW, THE           */
/*        SEQUENCE NUMBER AND BOTH SPARE BYTES ARE SET TO ZERO. IN       */
/*        THE FUTURE, THESE BYTES WILL REFLECT X.25 PROTOCOL USES.       */
/*                                                                       */
/*   OUTPUT - THIS PROCEDURE PLACES THE FIRST FIVE BYTES INTO THE        */
/*        LOCAL HOST RECEIVE BUFFER TO CREATE A PACKET.  THE PACKET      */
/*        IS POINTED TO BY LPTR AND THE SEMAPHORE LSEM IS SET.           */
/*                                                                       */
/*   INTERFACE - THE PROCEDURE IS CALLED FROM PROCEDURE ROUTE$IN FOR     */
/*        THOSE DATA PACKETS DESTINED FOR THE NETWORK ONLY.              */
/*                                                                       */
/*   NOTE:  THE HEADER INFORMATION SUPPLIED IS FOR DATAGRAM SERVICE      */
/*        ONLY.  ALSO, THE SEQUENCE AND SPARE BYTES ARE SET TO ZERO      */
```

```
                /*      TO ALLOW THE UNIDS MINIMAL OPERATIONAL CAPABILITY.  FOR      */
                /*      FUTURE SOFTWARE ENHANCEMENTS THIS WILL BE MODIFIED.         */
                /*                                                                  */
                /********************************************************************/

488   1         SEND$PACKET: PROCEDURE(TABLE$PTR, PORT);
489   2             DECLARE TABLE$PTR ADDRESS,
                          (PORT) BYTE,
                          LCOXTB BASED TABLE$PTR (1) BYTE;

490   2             LCOXTB( 0) = DESTINATION$ADDRESS;
491   2             LCOXTB( 1) = SOURCE$ADDRESS;
492   2             LCOXTB( 2) = 0;
493   2             LCOXTB( 3) = 0;
494   2             LCOXTB( 4) = 0;

495   2             DO CASE PORT;
496   3                 ;

497   3                 DO;
498   4                 LPTR$1 = TABLE$PTR;
499   4                 LSEM$1 = READY;
500   4                 END;

501   3                 DO;
502   4                 LPTR$2 = TABLE$PTR;
503   4                 LSEM$2 = READY;
504   4                 END;

505   3                 DO;
506   4                 LPTR$3 = TABLE$PTR;
507   4                 LSEM$3 = READY;
508   4                 END;

509   3                 DO;
510   4                 LPTR$4 = TABLE$PTR;
511   4                 LSEM$4 = READY;
512   4                 END;

513   3             END;    /* CASE */

514   2         END SEND$PACKET;

                /********************************************************************
                PROCEDURE DET$ADDR      DETERMINES THE DESTINATION OF DATA FROM LOCAL HOST

                THE PURPOSE OF THIS PROCEDURE IS TO DETERMINE THE DESTINATION OF DATAGRAMS
                    COMING FROM A HOST CONNECTED TO THE LOCAL PORTS 1 - 4.

                INPUT - THE INPUT IS A POINTER TO THE DATAGRAM HEADER TO BE INTERPRETED.
```

```
                PROCESSING - THE PROCEDURE FIRST EXTRACTS THE CONTROL$CODE FROM THE
                     INCOMING DATA TO DETERMINE WHICH ROUTING SCHEME IS USED.  THE
                     COUNTRY$CODE AND NETWORK$CODE ARE THEN EXTRACTED TO DETERMINE
                     THE DATA'S DESTINATION.  THE HOST$CODE IS EXTRACTED SO THAT THE
                     DESTINATION$ADDRESS CAN BE DETERMINED.  IF THE DATAGRAM IS DESTINED
                     FOR THE NETWORK, THE SOURCE ADDRESS IS ALSO EXTRACTED FOR THE
                     PACKET HEADER.

                OUTPUT - THIS PROCEDURE PLACES THE DESTINATION (0 OR 1) IN MEMORY
                     FOR THE PASSING ROUTINE AND RETURNS THE DESTINATION$ADDRESS.
                     DESTINATION = -1 DENOTES AN ADDRESSING ERROR IN THE DATAGRAM
                     HEADER.  THE CALLING PROCEDURE IS EXPECTED TO CHECK FOR DESTINATION
                     = -1.  FOR THE ERROR CASE, DESTINATION$ADDRESS = 0.  AN EXAMPLE OF
                     A DESTINATION$ADDRESS IS 21H, WHICH INDICATES UNIT=2 AND CHANNEL=1.

                INTERFACE - THIS PROCEDURE IS CALLED BY PROCEDURE ROUTE$IN.

                NOTES: 1. BYTE AND 0FH WILL MASK OUT THE UPPER 4-BITS.
                     2. BYTE AND 0F0H WILL MASK OUT THE LOWER 4-BITS.

                ********************************************** **************************/

515   1         DET$ADDR: PROCEDURE(TABLE$PTR);

516   2         DECLARE LOBITS BYTE,
                        HIBITS BYTE,
                        IPCNTL BYTE,
                        CONTROL$CODE BYTE,
                        COUNTRY$CODE BYTE,
                        NETWORK$CODE BYTE,
                        HOST$CODE BYTE,
                        SRC$HOST$CODE BYTE,
                        SRC$NET$CODE BYTE,
                        SRC$CONT$CODE BYTE,
                        SRC$CONTRY$CODE BYTE,
                        TABLE$PTR ADDRESS,
                        LCOXRX BASED TABLE$PTR(1) BYTE;

517   2             LOBITS = 0;
518   2             HIBITS = 0;
519   2             IPCNTL =0;
520   2             CONTROL$CODE = 0;
521   2             COUNTRY$CODE = 0;
522   2             NETWORK$CODE = 0;
523   2             HOST$CODE = 0;
524   2             DESTINATION$ADDRESS = 0;
525   2             SOURCE$ADDRESS = 0;
526   2             DESTINATION = -1;

527   2             IPCNTL = LCOXRX(1) AND 0E0H;
528   2             IF IPCNTL = 0 THEN
```

```
529   2          DO;

530   3          CONTROL$CODE = ROR(LCOXRX(16), 4) AND 0FH;
531   3          IF CONTROL$CODE = 00 THEN
532   3              DO;
533   4              COUNTRY$CODE = LCOXRX(16) AND 0FH;
534   4              IF COUNTRY$CODE = THIS$COUNTRY$CODE THEN  /* ELSE TO UNID 0 */
535   4                  DO;
536   5                  NETWORK$CODE = ROR(LCOXRX(17), 4) AND 0FH;
537   5                  IF (NETWORK$CODE <= MAX$NETWORK$CODE) THEN
538   5                      DO;
539   6                      IF (COUNTRY$CODE <> THIS$COUNTRY$CODE) OR
                                   ((NETWORK$CODE)<> THIS$UNID$NBR) THEN
540   6                          DESTINATION = 1;        /* LOC TO NET */
                               ELSE
541   6                          DESTINATION = 0;        /* LOC TO LOC */
542   6                      LOBITS = (ROR(LCOXRX(18), 4) AND 0FH);
543   6                      HIBITS = (ROL(LCOXRX(17), 4) AND 0F0H);
544   6                      HOST$CODE = LOBITS OR HIBITS;
545   6                      IF (HOST$CODE >=0) AND (HOST$CODE <= 63) THEN
546   6                          DESTINATION$ADDRESS = (ROL(NETWORK$CODE, 4) AND
                                                       0F0H) OR 1;
                               ELSE
547   6                          IF (HOST$CODE >=64) AND (HOST$CODE <= 127) THEN
548   6                              DESTINATION$ADDRESS = (ROL(NETWORK$CODE, 4) AND
                                                           0F0H) OR 2;
                                   ELSE
549   6                              IF (HOST$CODE >= 128) AND (HOST$CODE <= 191) THEN
550   6                                  DESTINATION$ADDRESS = (ROL(NETWORK$CODE, 4) AND
                                                               0F0H) OR 3;
                                       ELSE
551   6                                  IF (HOST$CODE >= 192) AND (HOST$CODE <=255) THEN
552   6                                    DESTINATION$ADDRESS = (ROL(NETWORK$CODE, 4) AND
                                                                 0F0H) OR 4;
                               END;
                           ELSE
554   5                      DO;  /* NOT WITHIN NETWORK CODES FOR THIS$COUNTRY$CODE */
555   6                      STATTB(4) = STATTB(4) + 1;
556   6                  END;
557   5                  END;
                       ELSE
558   4                  DO;     /* NOT FOR THIS COUNTRY, SEND TO NETWORK/UNID 0 */
559   5                  STATTB(3) = STATTB(3) + 1;
560   5              END;
561   4              END;
                   ELSE
562   3              DO;    /* IT IS AT THIS POINT THAT OTHER X.121 CONTROL CODES
                            SOFTWARE SUPPORT WILL BE INCORPORATED INTO THE NETWORK  */
563   4              STATTB(2) = STATTB(2) + 1;
564   4          END;
```

```
565  3          END;
                ELSE
566  2              IF IPCNTL = 0C0H THEN
567  2                  DO;
                        /* IP CONTROL; LOOK AT SUBCODE, CHECK SUBCODE FOR SQUELCH
                        OR UNSQUELCH AND ACT ACCORDINGLY */
568  3                  END;
                    ELSE
569  2                  DO;
570  3                  DESTINATION = -1;
571  3                  STATTB(10) = STATTB(10) + 1;
572  3                  END;


573  2          IF DESTINATION = 1 THEN    /* LOC TO NET, GET SOURCE INFO */
574  2              DO;
575  3              SRC$NET$CODE = ROR(LC0XRX(13), 4) AND 0FH;
576  3              IF (SRC$NET$CODE = THIS$UNID$NBR) THEN
577  3                  DO;
578  4                  LOBITS = (ROR(LC0XRX(14), 4) AND 0FH);
579  4                  HIBITS = (ROL(LC0XRX(13), 4) AND 0F0H);
580  4                  SRC$HOST$CODE = LOBITS OR HIBITS;
581  4                  IF (SRC$HOST$CODE >=0) AND (SRC$HOST$CODE <= 63) THEN
582  4                      SOURCE$ADDRESS = (ROL(SRC$NET$CODE, 4) AND 0F0H) OR 1;
                        ELSE
583  4                      IF (SRC$HOST$CODE >=64) AND (SRC$HOST$CODE <= 127) THEN
584  4                          SOURCE$ADDRESS = (ROL(SRC$NET$CODE, 4) AND 0F0H) OR 2;
                            ELSE
585  4                          IF (SRC$HOST$CODE >= 128) AND (SRC$HOST$CODE <= 191) THEN
586  4                            SOURCE$ADDRESS = (ROL(SRC$NET$CODE, 4) AND 0F0H) OR 3;
                                ELSE
587  4                              IF (SRC$HOST$CODE >= 192) AND (SRC$HOST$CODE <=255)
                                    THEN
588  4                                  SOURCE$ADDRESS = (ROL(SRC$NET$CODE, 4) AND 0F0H)
                                                        OR 4;
                        END;
                    ELSE
590  3                  DO;
591  4                  DESTINATION = -1;
592  4                  STATTB(9) = STATTB(9) + 1;
593  4                  END;

594  3              END;

595  2          IF DESTINATION = -1 THEN
596  2              STATTB(0) = STATTB(0) + 1;

597  2      END DET$ADDR;

           /*************************************************************************
           PROCEDURE DET$ADDR$NL    DETERMINES THE DESTINATION OF DATA FROM THE NETWORK
```

```
                THE PURPOSE OF THIS PROCEDURE IS TO DETERMINE THE DESTINATION OF DATA
                     COMING FROM THE NETWORK SIDE OF THE UNID TO A LOCAL HOST.

                INPUT - THE INPUT IS A POINTER INDICATING THE TABLE LOCATION OF
                     THE DATA HEADER TO BE EVALUATED.

                PROCESSING - THE PROCEDURE EXTRACTS THE DESTINATION$ADDRESS FROM THE
                     SECOND BYTE OF THE DATA PACKET AND RETURNS THE CORRESPONDING
                     DESTINATION.

                OUTPUT - THIS PROCEDURE RETURNS THE DESTINATION (1,2,3, OR 4) OF THE
                     DATA COMING FROM THE NETWORK TO A LOCAL HOST.  A NEGATIVE VALUE
                     IS AN ERROR CONDITION.

                INTERFACE - THIS PROCEDURE IS CALLED BY PROCEDURE ROUTE$IN.

                NOTES: 1. BYTE AND 07H WILL MASK OUT THE UPPER 5-BITS.

                ************************************************************************/

598   1         DET$ADDR$NL: PROCEDURE(TABLE$PTR) BYTE;

599   2             DECLARE  PORT BYTE,
                           TABLE$PTR ADDRESS,
                           NTOXRX BASED TABLE$PTR (1) BYTE;

600   2             PORT = NTOXRX(0) AND 0FH;
601   2             IF (PORT >= 1 AND PORT <= 4) THEN
602   2                 RETURN PORT;
                      ELSE
603   2                 DO·
604   3                 PORT = -1;
605   3                 STATTB(1) = STATTB(1) + 1;  /*  INCREMENT LOCAL ERROR COUNT  */
606   3                 STATTB(0) = STATTB(0) + 1;
607   3                 RETURN PORT;
608   3             END;

609   2         END DET$ADDR$NL;

                /************************************************************************/
                /*                                                                      */
                /* PROCEDURE  MOVETO$LOCAL  ROUTE A DATAGRAM TO THE LOCAL HOST          */
                /*                                                                      */
                /*   THE PURPOSE OF THIS PROCEDURE IS TO ROUTE DATAGRAMS FROM A         */
                /*        LOCAL HOST OR FROM THE NETWORK RECEIVE TABLES TO THE CORRECT   */
                /*        LOCAL HOST TRANSMIT CHANNEL.                                  */
                /*                                                                      */
                /*   INPUT - A POINTER TO THE DATAGRAM TO BE MOVED AND A PORT NUMBER    */
                /*        TO WHERE THE DATAGRAM IS DESTINED.                            */
                /*                                                                      */
```

```
                /*   PROCESSING - THE PROCEDURE CHECKS EACH INPUT BUFFER'S ADDRESSS      */
                /*        THE TABLE THAT WAS SERVICED (DATAGRAM REMOVED)                 */
                /*        HAS ITS TABLE POINTERS UPDATED BY SRVC$TAB$HSKP.  WHEN THE     */
                /*        FRAME FROM THE NETWORK IS TRANSMITTED TO THE HOSTS THE FIRST   */
                /*        SEVEN BYTES OF HEADER INFORMATION ARE STRIPPED OFF BEFORE      */
                /*        BEFORE PASSING THE POINTER TO THIS PROCEDURE.                  */
                /*                                                                       */
                /*   OUTPUT - A DATAGRAM IS MOVED TO THE LOCAL HOST TRANSMIT BUFFER FOR  */
                /*        TRANSMISSION TO THE LOCAL HOST.                                */
                /*                                                                       */
                /*   INTERFACE - THIS PROCEDURE IS CALLED BY ROUTE$IN.                   */
                /*                                                                       */
                /*************************************************************************/

610   1     MOVETO$LOCAL: PROCEDURE(TABLE$PTR, PORT);

611   2         DECLARE PORT BYTE,
                      TABLE$PTR ADDRESS;

612   2         IF(PORT >= 1 AND PORT <= 4) THEN
613   2             DO;
614   3             DO CASE PORT;

615   4                 ;     /*   CASE ZERO IS NULL   */

616   4                 CALL MOVE(DATA$GRAM$SIZE, TABLE$PTR, .LC01TX(TX01NE));

617   4                 CALL MOVE(DATA$GRAM$SIZE, TABLE$PTR, .LC02TX(TX02NE));

618   4                 CALL MOVE(DATA$GRAM$SIZE, TABLE$PTR, .LC03TX(TX03NE));

619   4                 CALL MOVE(DATA$GRAM$SIZE, TABLE$PTR, .LC04TX(TX04NE));

620   4             END;                  /* END CASE */
621   3             CALL LD$TAB$HSKP(PORT + 4);
622   3             END;
623   2         ELSE DO;
624   3             STATTB(L$RI$DEST$ERR) = STATTB(L$RI$DEST$ERR) + 1;
625   3             STATTB(0) = STATTB(0) + 1;
626   3         END;

627   2     END MOVETO$LOCAL;

                /*************************************************************************/
                /* PROCEDURE   ROUTE$IN    ROUTES DATAGRAMS FROM THE HOST OR NETWORK     */
                /*                                                                       */
                /*   THE PURPOSE OF THIS PROCEDURE IS TO ROUTE DATAGRAMS                 */
                /*        FROM THE FOUR LOCAL HOST RECEIVE BUFFERS TO THE NETWORK        */
                /*        AND FROM THE NETWORK TO THE FOUR LOCAL HOST TRANSMIT BUFFERS.  */
                /*                                                                       */
                /*   INPUT - HOST DATAGRAMS OR NETWORK PACKETS ARE ROUTED VIA EVALUATION */
```

```
                /*        OF THE DATAGRAM OR PACKET HEADERS                    */
                /*                                                             */
                /*   PROCESSING - THE PROCEDURE CHECKS EACH OF THE LOCAL INPUT BUFFER'S */
                /*        ADDRESSES FOR HOST DATAGRAMS.    IF ANY HOST DATA IS READY, */
                /*        THE DESTINATION IS DETERMINED VIA PROCEDURE DET$ADDR.  ONCE */
                /*        THE DESTINATION IS DETERMINED THEN THE DATA IS EITHER SENT */
                /*        TO A LOCAL HOST TRANSMIT BUFFER (LOCAL TO LOCAL TRANSFER) */
                /*        VIA PROCEDURE MOVETO$LOCAL OR THE HOST DATA IS CONVERTED */
                /*        INTO A PACKET BY SEND$PACKET AND THEN SENT TO THE NETWORK */
                /*        SIDE OF THE UNIT VIA A POINTER AND SEMAPHORE IN SEND$PACKET. */
                /*        BOTH THE BUFFER TABLE THAT IS LOADED AND THE TABLE THAT IS */
                /*        SERVICED HAVE THEIR ADDRESSS HOUSECLEANED BY LD$TAB$HSKP AND */
                /*        SRVC$TAB$HSKP.                                       */
                /*                                                             */
                /*   OUTPUT - EITHER A DATAGRAM IS MOVED TO A LOCAL HOST TRANSMIT BUFFER */
                /*        OR THE DATAGRAM IN THE LOCAL HOST RECEIVE BUFFER IS CONVERTED */
                /*        TO A PACKET  FOR THE NETWORK (DATA LINK LAYER).      */
                /*                                                             */
                /*   INTERFACE - THIS PROCEDURE IS CALLED IN AN ENDLESS LOOP BY THE */
                /*        MAIN PROGRAM.                                        */
                /*                                                             */
                /*******************************************************************/

628   1       ROUTE$IN: PROCEDURE;
629   2           DECLARE NETRT BASED NPTR$1 (1) BYTE,
                        NETR2 BASED NPTR$2 (1) BYTE;
                            /* NETRX POINTS TO A PACKET SIZED ENTRY */

630   2           IF (((LCO1NE - LCO1NS) >= DATA$GRAM$SIZE) OR (LCO1NS > LCO1NE)) THEN
631   2               DO;
632   3               CALL DET$ADDR(.LCO1RX(LCO1NS + 5));
633   3               IF DESTINATION = 0 THEN
634   3                   DO;
635   4                   CALL MOVETO$LOCAL(.LCO1RX(LCO1NS + 5), (DESTINATION$ADDRESS AND
                                                            0FH));
636   4                   END;
                        ELSE
637   3                   IF DESTINATION = 1 THEN
638   3                       DO;
639   4                       IF LSEM$1 = DONE THEN
640   4                           CALL SEND$PACKET(.LCO1RX(LCO1NS), 1);
641   4                       END;
                            ELSE
642   3                       DO;
643   4                       STAT1$(L$RT$DEST$ERR) = STAT1$(L$RT$DEST$ERR) + 1;
644   4                       END;
645   3               CALL SRVC$TAB$HSKP(1);
646   3               END;

647   2           IF (((LCO2NE - LCO2NS) >= DATA$GRAM$SIZE) OR (LCO2NS > LCO2NE)) THEN
648   2               DO;
```

```
 55  1      DECLARE MSG10(*) BYTE DATA(CR,LF,
            'Timeout or receive TR from UNID');

            /*************************************************************************/
            /*   PROCEDURE  DELAY     CAUSES A VARIABLE DELAY                        */
            /*                                                                       */
            /*   THE PURPOSE OF THIS PROCEDURE IS TO ADD DELAY TO PARTS OF THE       */
            /*   INITIALIZATION PROCEDURE THAT IS TIME DEPENDENT.                    */
            /*                                                                       */
            /*   INPUT - NONE                                                        */
            /*   PROCESSING - USES BUILT IN PROCEDURE IN A LOOP                      */
            /*   OUTPUT - NONE                                                       */
            /*   INTERFACE - NONE AT THIS TIME                                       */
            /*************************************************************************/

 56  1      DELAY: PROCEDURE(MILLISEC);
 57  2          DECLARE (I, MILLISEC) BYTE;

 58  2          DO I=1 TO MILLISEC;
 59  3             CALL TIME(25);/* TIME IS A BUILT IN FUNCTION OF PLM80 WHICH CAUSES*/
                              /* A DELAY BASED ON THE NUMBER IN PARENS             */
 60  3          END;
 61  2      END DELAY;

            /*************************************************************************
               PROCEDURES TO CONVERT HEX TO ASCII FOR USE WITH DISPLAYING A FRAME
            *************************************************************************/

 62  1      HEX$ASC: PROCEDURE(VAL, I);
 63  2          DECLARE (VAL, I) BYTE;

 64  2          TEMP1(I) = ASCII(SHR(VAL,4) AND 0FH);
 65  2          TEMP1(I+1) = ASCII(VAL AND 0FH);

 66  2      END HEX$ASC;

 67  1      ASC$HEX: PROCEDURE(C) BYTE;
 68  2          DECLARE C BYTE;

 69  2          IF (C >= '0' AND C <= '9') THEN
 70  2              RETURN (C-30H);
             ELSE
 71  2              IF (C >= 'A' AND C <= 'F') THEN
 72  2                  RETURN (C-37H);
                 ELSE
 73  2                  IF (C >= 'a' AND C <= 'f') THEN
 74  2                      RETURN (C-57H);

 75  2          RETURN C

 76  2      END ASC$HEX;
```

```
                                                        /* 8251 RCV & XMIT INT  */

 34  1      DECLARE     STARTUP$HDR(*) BYTE DATA(CR,LF,
                '                        UNID II #2 LOCAL OS',CR,LF,
                '                       SUPPORTING S/W ON CP/M',CR,LF,
                '                        VERS 1.0, 25 SEP 84',CR,LF,
                '                           EXECUTING ',CR,LF);

            /* THE FOLLOWING TEST POINTS ARE USED TO FOLLOW THE DATA WITHIN THE UNID */

 35  1      DECLARE TP$50(*) BYTE DATA(CR,LF,
                'TP$50              Channel Number = ');
 36  1      DECLARE TP$51A(*) BYTE DATA(CR,LF,
                'TP$51A             Destination Network = ');
 37  1      DECLARE TP$52A(*) BYTE DATA(CR,LF,
                'TP$52A             Destination Host = ');
 38  1      DECLARE TP$54(*) BYTE DATA(CR,LF,
                'TP$54              Loaded test datagram in TX01TB');
 39  1      DECLARE TP$55A(*) BYTE DATA(CR,LF,
                'TP$55A             Reading test datagram from TX01TB');
 40  1      DECLARE TP$56A(*) BYTE DATA(CR,LF,
                'TP$56A             Reading test datagram from RX01TB');
 41  1      DECLARE TP$57(*) BYTE DATA(CR,LF,
                'TP$57              Sent TR');
 42  1      DECLARE TP$58(*) BYTE DATA(CR,LF,
                'TP$58              Sent TA');
 43  1      DECLARE TP$59(*) BYTE DATA(CR,LF,
                'TP$59              Received TR');
 44  1      DECLARE TP$60(*) BYTE DATA(CR,LF,
                'TP$60              Received TA');

 45  1      DECLARE MSG1(*) BYTE DATA(CR,LF,
                'Do you want to load the test message (Y/N) [N] ? ');
 46  1      DECLARE MSG1A(*) BYTE DATA(CR,LF,
                'Do you want TR/TA handshake (Y/N) [N] ? ');
 47  1      DECLARE MSG2(*) BYTE DATA(CR,LF,
                'Do you want to stop the test (Y/N) [N] ? ');
 48  1      DECLARE MSG3(*) BYTE DATA(CR,LF,
                'Load into which host channel (1,2,3,4)? ');
 49  1      DECLARE MSG4(*) BYTE DATA(CR,LF,
                'How many datagrams (0 - 9)? ');
 50  1      DECLARE MSG5(*) BYTE DATA(CR,LF,
                'Destination network code (1,2,3) = ');
 51  1      DECLARE MSG6(*) BYTE DATA(CR,LF,
                'Destination host code (0 - FFH) = ');
 52  1      DECLARE MSG7(*) BYTE DATA(CR,LF,
                'Finished simulation, rebooting to CP/M',CR,LF);
 53  1      DECLARE MSG8(*) BYTE DATA(CR,LF,
                'Timeout on receive datagram from UNID');
 54  1      DECLARE MSG9(*) BYTE DATA(CR,LF,
                'Timeout on receive TA from UNID');
```

```
 32  1      DECLARE
                    CHAN$PTR    ADDRESS,
                    RXTA$TRIES  BYTE,
                    TEMP1(*) BYTE INITIAL('XXEMPTY EMPTYOXX'),
                    TEMP2(*) BYTE INITIAL('XXEMPTY EMPTYOXX'),
                    (TRTA, TXTR, TXTA, RXTR, RXTA, CHAR) BYTE,
                    FOREVER   BYTE,
                    TRANS$1$RDY  BYTE,
                    BYTES$SENT$1 BYTE,
                    BYTES$RECV$1 BYTE,
                    MSGNUM       BYTE,

             /*************************************************************************/
             /*    DATA TABLES USED IN THIS PROGRAM                                   */
             /*************************************************************************/

                    RX01TB (DATA$TABLE$SIZE) BYTE,
                    RX01NS ADDRESS,
                    RX01NE ADDRESS,
                    RX01SZ ADDRESS,

                    TX01TB(DATA$TABLE$SIZE) BYTE,
                    TX01NS ADDRESS,
                    TX01NE ADDRESS,
                    TX01SZ ADDRESS,

                    DESTINATION  ADDRESS,   /* DESTINATION OF THE PACKET  */
                    DESTINATION$ADDRESS BYTE, /* DESTIN ADDR OF DATAGRAM */
                    SOURCE$ADDRESS BYTE;      /* SOURCE ADDR OF DATAGRAM */

                      /*  MISCELLANEOUS DECLARATIONS  */

 33  1      DECLARE
                    TR          LITERALLY   '42H',  /* TR, TA FOLLOWS NETOS */
                    TA          LITERALLY   '41H',  /* CONVENTION           */
                    BUSY        LITERALLY    'OFFH',
                    TRUE        LITERALLY    'OFFH',
                    FALSE       LITERALLY    '00H',
                    NMBR$MSK    LITERALLY    '07H',
                    CR          LITERALLY    '0DH',
                    LF          LITERALLY    '0AH',
                    SOURCE      LITERALLY    '12',
                    DESTIN      LITERALLY    '16',
                    ESC         LITERALLY    '1BH',
                    BDOS2       LITERALLY    '2',   /* BDOS CALL 2-CONSOLE OUTPUT */
                    BDOS9       LITERALLY    '9',   /* BDOS CALL 9-PRINT STRING
                                                       UNTIL $ */
                    BDOS10      LITERALLY    '10',  /* BDOS CALL 10-READ BUFFER */
                    RCV$STATE   LITERALLY '00010110B', /* MODE INSTRUCTION FOR */
                                                       /* 8251 USART RCV INT */
                    TRANS$STATE LITERALLY '00110111B'; /* MODE INSTRUCTION FOR */
```

```
 15   1      CONIN: PROCEDURE BYTE EXTERNAL;
 16   2      END CONIN;

 17   1      CONOUT: PROCEDURE(CHAR) EXTERNAL;
 18   2          DECLARE CHAR BYTE;
 19   2      END CONOUT;

 20   1      BDOS: PROCEDURE(FUN$NUM, VALUE) ADDRESS EXTERNAL;
 21   2          DECLARE FUN$NUM BYTE,
                      VALUE ADDRESS;
 22   2      END BDOS;

 23   1      EXIT: PROCEDURE EXTERNAL;
 24   2      END EXIT;

 25   1      DECLARE RESULT ADDRESS;
 26   1      DECLARE BUFFER(128) BYTE;
 27   1      DECLARE CRLF(*) BYTE DATA(0DH,0AH);
 28   1      DECLARE     MESSAGE(*) BYTE DATA(0DH, 0AH,
              'THIS IS THE TEST MESSAGE                    THIS IS THE TEST
                                              MESSAGE!!!!!');
 29   1      DECLARE     ASCII(*) BYTE DATA('0123456789ABCDEF');
 30   1      DECLARE (CHAN$NUM, DEST$NET$CODE, DEST$HOST$CODE) BYTE;

 31   1      DECLARE    DATA$GRAM$SIZE  LITERALLY '128',/* NUMBER OF BYTES FROM HOST */
                        PACKETS$IN$TABLE LITERALLY '10',
                        DATA$TABLE$SIZE LITERALLY '1280',/* NUMBR OF BYTES IN TABLE */
                        TCP$DATA$SIZE  LITERALLY '72',/* TCP DATA SIZE */
                        MAX$RXTA$TRIES  LITERALLY '3',/* MAX NUMBER OF TA WAIT TRIES */

                        /* FOLLOWING ARE NETWORK DEFINED VARIABLES */
                        /* NOTES:1. THIS$UNID$NBR MUST REFLECT WHICH UNID THIS IS.
                             2. THIS$COUNTRY$CODE MUST REFLECT THE AREA TO WHICH
                                  THIS UNID IS LOCATED.
                             3. MAX$COUNTRY$CODE WILL INDICATE WHICH COUNTRY CODES
                                  ARE CURRENTLY OPERATIONAL. CC=0000 IS RESERVED FOR
                                  THE DELNET MONITOR.
                             4. MAX$NETWORK$CODE WILL INDICATE HOW MANY UNIDS ARE
                                  CURRENTLY OPERATIONAL WITHIN A PARTICULAR COUNTRY.
                             5. FOR DETAILED INFORMATION ON THE ABOVE REFER TO
                                  PHISTER'S THESIS, APPENDIX C. */

                   THIS$UNID$NBR    LITERALLY '2',  /* UNIQUE ADDRESS FOR THIS UNID */
                   THIS$COUNTRY$CODE LITERALLY '9', /* CC WHERE THIS UNID RESIDES */
                   MAX$COUNTRY$CODE LITERALLY '9',  /* INDICATES COUNTRY$CODES IN USE */
                   MAX$NETWORK$CODE LITERALLY '3';/* INDICATES UNIDS OPERATIONAL IN NET*/

                  /*************************************************************/
                  /*   ADDITIONAL GENERAL DECLARES NEEDED FOR THIS PROGRAM     */
                  /*************************************************************/
```

```
 15   1      CONIN: PROCEDURE BYTE EXTERNAL;
 16   2      END CONIN;

 17   1      CONOUT: PROCEDURE(CHAR) EXTERNAL;
 18   2          DECLARE CHAR BYTE;
 19   2      END CONOUT;

 20   1      BDOS: PROCEDURE(FUN$NUM, VALUE) ADDRESS EXTERNAL;
 21   2          DECLARE FUN$NUM BYTE,
                      VALUE ADDRESS;
 22   2      END BDOS;

 23   1      EXIT: PROCEDURE EXTERNAL;
 24   2      END EXIT;

 25   1      DECLARE RESULT ADDRESS;
 26   1      DECLARE BUFFER(128) BYTE;
 27   1      DECLARE CRLF(*) BYTE DATA(0DH,0AH);
 28   1      DECLARE     MESSAGE(*) BYTE DATA(0DH, 0AH,
              'THIS IS THE TEST MESSAGE                    THIS IS THE TEST
                                                 MESSAGE!!!!!');
 29   1      DECLARE     ASCII(*) BYTE DATA('0123456789ABCDEF');
 30   1      DECLARE (CHAN$NUM, DEST$NET$CODE, DEST$HOST$CODE) BYTE;

 31   1      DECLARE    DATA$GRAM$SIZE  LITERALLY '128',/* NUMBER OF BYTES FROM HOST */
                         PACKETS$IN$TABLE LITERALLY '10',
                         DATA$TABLE$SIZE LITERALLY '1280',/* NUMBR OF BYTES IN TABLE */
                         TCP$DATA$SIZE  LITERALLY '72',/* TCP DATA SIZE */
                         MAX$RXTA$TRIES  LITERALLY '3',/* MAX NUMBER OF TA WAIT TRIES */

                         /* FOLLOWING ARE NETWORK DEFINED VARIABLES */
                         /* NOTES:1. THIS$UNID$NBR MUST REFLECT WHICH UNID THIS IS.
                              2. THIS$COUNTRY$CODE MUST REFLECT THE AREA TO WHICH
                                   THIS UNID IS LOCATED.
                              3. MAX$COUNTRY$CODE WILL INDICATE WHICH COUNTRY CODES
                                   ARE CURRENTLY OPERATIONAL. CC=0000 IS RESERVED FOR
                                   THE DELNET MONITOR.
                              4. MAX$NETWORK$CODE WILL INDICATE HOW MANY UNIDS ARE
                                   CURRENTLY OPERATIONAL WITHIN A PARTICULAR COUNTRY.
                              5. FOR DETAILED INFORMATION ON THE ABOVE REFER TO
                                   PHISTER'S THESIS, APPENDIX C. */

                    THIS$UNID$NBR    LITERALLY '2',  /* UNIQUE ADDRESS FOR THIS UNID */
                    THIS$COUNTRY$CODE LITERALLY '9', /* CC WHERE THIS UNID RESIDES */
                    MAX$COUNTRY$CODE LITERALLY '9',  /* INDICATES COUNTRY$CODES IN USE */
                    MAX$NETWORK$CODE LITERALLY '3';/* INDICATES UNIDS OPERATIONAL IN NET*/

                /*************************************************************************/
                /*   ADDITIONAL GENERAL DECLARES NEEDED FOR THIS PROGRAM                 */
                /*************************************************************************/
```

4a. CP/M Host

The purpose of this program is to operate a CP/M system as a simulated host to a UNID II. The program is similar to the SBC 544 simulation in that many of the same variables are used. In addition, an assembly language program is used to interface the PL/M I/O calls to the CP/M BDOS calls.

```
 858   4                    TRTA$1, TRTA$2, TRTA$3, TRTA$4 = FALSE;
 859   4                END;
 860   3             CALL SNDSEQ(.MSG1, SIZE(MSG1));
 861   3             HALT;
 862   3          END;

 863   2       END SET$TRTA;

             /*****************************************************************/
             /*     THIS IS THE MAIN BODY OF THE PROGRAM                      */
             /*****************************************************************/

 864   1       BEGIN:

                 DISABLE;
 865   1          CALL S$MASK(SIM$MASK);
 866   1          CALL INITIALIZE$BOARD;
 867   1          CALL SNDSEQ(.HEADER, SIZE(HEADER));
 868   1          CALL SNDSEQ(.TP$5, SIZE(TP$5));
 869   1          CALL INIT;
 870   1          CALL SNDSEQ(.TP$6, SIZE(TP$6));
 871   1          CALL INIT$TAB;
 872   1          CALL SNDSEQ(.TP$7, SIZE(TP$7));
 873   1          ENABLE;

 874   1          CALL SET$TRTA;
 875   1          FOREVER = TRUE;
 876   1          CALL SNDSEQ(.TP$8, SIZE(TP$8));
 877   1          DO WHILE FOREVER;
 878   2             CALL ROUTE$IN;
 879   2             CALL ROUTE$OUT;
 880   2             CALL LOOP;
 881   2          END;

 882   1       END MAIN;

             /****************************** THE END ******************************/

MODULE INFORMATION:

     CODE AREA SIZE     = 18A6H   6310D
     VARIABLE AREA SIZE = 14A7H   5287D
     MAXIMUM STACK SIZE = 000EH     14D
     1834 LINES READ
     0 PROGRAM ERROR(S)

END OF PL/M-80 COMPILATION
```

```
833  2          IF (LSEM$1 = READY AND NSEM$1 = DONE) AND (NOT SEND$1) THEN
834  2              CALL SERVICE$LOOP(LPTR$1, 1);

835  2          IF (LSEM$2 = READY AND NSEM$1 = DONE) AND (NOT SEND$2) THEN
836  2              CALL SERVICE$LOOP(LPTR$2, 2);

837  2          IF (LSEM$3 = READY AND NSEM$1 = DONE) AND (NOT SEND$3) THEN
838  2              CALL SERVICE$LOOP(LPTR$3, 3);

839  2          IF (LSEM$4 = READY AND NSEM$1 = DONE) AND (NOT SEND$4) THEN
840  2              CALL SERVICE$LOOP(LPTR$4, 4);

841  2      END LOOP;

              /*************************************************************************
              PROCEDURE SET$TRTA        ALLOWS OPERATOR SELECTION OF WHICH HOST PORT
                                        WILL USE THE TRTA HANDSHAKE

              PURPOSE OF THIS PROCEDURE IS TO ALLOW OPERATOR INTERACTION AT THE TERMINAL
                   TO DETERMINE WHICH OF THE FOUR LOCAL HOST PORTS WILL USE THE TRTA
                   HANDSHAKE.

              INPUT - DATA (PORT NUMBERS) PROVIDED INTERACTIVELY BY THE OPERATOR

              PROCESSING - THE OPERATOR IS QUERIED FOR INPUT TO DETERMINE WHICH OF THE
                   FOUR LOCAL HOST PORTS WILL USE THE TRTA HANDSHAKE.

              OUTPUT - THE TRTA BOOLEAN FLAGS ARE SET OR RESET.

              INTERFACE - CALLED BY MAIN PROCEDURE

              *************************************************************************/
842  1      SET$TRTA: PROCEDURE;

843  2          CALL SNDSEQ(.MSG1, SIZE(MSG1));
844  2          HALT;
845  2          DO WHILE ((CHAR$X = 'Y') OR (CHAR$X = 'y'));
846  3              IF ((CHAR$X = 'Y') OR (CHAR$X = 'y')) THEN
847  3                  DO;
848  4                  CALL SNDSEQ(.MSG2, SIZE(MSG2));
849  4                  HALT;
850  4                  CHAR$X = CHAR$X - 31H;
851  4                  IF ((CHAR$X >= 0) AND (CHAR$X <= 3)) THEN
852  4                      DO CASE CHAR$X;
853  5                          TRTA$1 = TRUE;
854  5                          TRTA$2 = TRUE;
855  5                          TRTA$3 = TRUE;
856  5                          TRTA$4 = TRUE;
857  5                      END;
                        ELSE
```

```
811   2          NTO1RX(NTO1NE + 1) = 0;
812   2          NTO1RX(NTO1NE + 2) = LC0XRX(1);
813   2          NTO1RX(NTO1NE + 3) = LC0XRX(0);     /* SWAP PACKET HEADER */
814   2          DO INDEX = 2 TO (PACKET$SIZE - 1);          /* SWAP DATA */
815   3              NTO1RX(NTO1NE + INDEX + 2) = LC0XRX(INDEX);
816   3          END;

817   2          DO INDEX = 0 TO 3;                  /* SWAP IP DEST & SOURCE */
818   3              NTO1RX(NTO1NE + INDEX + 19) = LC0XRX(INDEX + 21);
819   3              NTO1RX(NTO1NE + INDEX + 23) = LC0XRX(INDEX + 17);
820   3          END;

821   2          CALL LD$TAB$HSKP(9);
822   2          DO CASE PORT;
823   3              ;
824   3              LSEM$1 = DONE;
825   3              LSEM$2 = DONE;
826   3              LSEM$3 = DONE;
827   3              LSEM$4 = DONE;
828   3          END;
829   2          NPTR$1 = .NTO1RX(NTO1NS + 2);
830   2          NSEM$1 = READY;

831   2      END SERVICE$LOOP;

              /*************************************************************************/
              PROCEDURE LOOP      SIMULATES A DATAGRAM TRAVERSING A NETWORK OF UNIDS

              PROCEDURE - THE LOOP PROCEDURE SIMULATES THE ACTIONS OF THE SBC 88/45 BOARD
                   WITH THE USE OF SEMAPHORES AND POINTERS.  IT CALLS THE ROUTINE
                   SERVICE$LOOP WHICH SWAPS DESTINATION AND SOURCE HEADERS IN THE
                   DATAGRAM IP HEADER AND PACKET HEADER . THE PACKET IS THEN MOVED
                   TO THE NTO1RX TABLE IN SYSTEM MEMORY, SIMULATING THE ACTIONS OF THE
                   SBC 88/45 BOARD.

              INPUT - DATAGRAMS IN THE LOCAL HOST RECEIVE BUFFERS, DETERMINED BY THE
                   SEMAPHORES LSEM AND NSEM.

              PROCESSING - WHEN THE SEMAPHORES ARE CORRECT AND A DATAGRAM TRANSMISSION
                   IS NOT IN PROGRESS, SERVICE$LOOP IS CALLED TO MOVE A DATAGRAM INTO
                   THE NETWORK RECEIVE BUFFER.

              OUTPUT - A DATAGRAM WITH APPROPRIATE PACKET HEADER IN THE NETWORK RECEIVE
                   BUFFER.

              INTERFACE - CALLED BY MAIN PROGRAM.

              /*************************************************************************/
832   1      LOOP: PROCEDURE;        /* NSEM$1 IS USED FOR THE SIMULATION AND SHOULD NOT
                                    BE USED FOR THE 88/45 OPERATIONAL SOFTWARE.  THE 88/45
                                    NEEDS ONLY TO INTERROGATE THE LSEM$X VARIABLE.       */
```

```
 789   3                  DO;
 790   4                  CALL SNDSEQ(.TP$3, SIZE(TP$3));
 791   4                  TXTR$4 = TRUE;
 792   4                  SEND$4 = TRUE;
 793   4                  OUTPUT(US$P3$DATA) = TR;
 794   4                  END;
 795   3              IF ((NOT TRTA$4) OR ((TXTR$4 AND RXTA$4) AND
                                ((NOT RXTR$4) AND (NOT TXTA$4)))) THEN
 796   3                  DO;
 797   4                  CALL SNDSEQ(.TP$4, SIZE(TP$4));
 798   4                  SEND$4 = TRUE;
 799   4                  DISABLE;
 800   4                  OUTPUT(IC$PORTB) = INPUT(IC$PORTB) AND 07FH;
 801   4                  ENABLE;
 802   4                  END;
 803   3              END;

 804   2          DISABLE;
 805   2          OUTPUT(IC$PORTB) = INPUT(IC$PORTB) AND 0BFH;
 806   2          ENABLE;

 807   2      END ROUTE$OUT;

              /*************************************************************************
              PROCEDURE SERVICE$LOOP     A SOFTWARE LOOP TO SIMULATE A DATAGRAM TRAVER-
                                         SING A NETWORK OF UNIDS

              PURPOSE - TO LOOP A FRAME AROUND AT THE NETWORK LAYER.  THE SOURCE AND
                  DESTINATION ADDRESSES ARE SWITCHED AND THE PACKET IS PUT INTO THE
                  NETWORK LAYER RECEIVE TABLE.  USED FOR SIMULATION PURPOSES ONLY.

              INPUT - A POINTER TO THE DATAGRAM TO BE LOOPED AND THE RECEIVE PORT NUMBER
                   FROM WHICH IT CAME.

              PROCESSING - THE SOURCE AND DESTINATION ADDRESSES IN THE DATAGRAM IP
                   HEADER ARE SWAPPED.  THE DATAGRAM IS THEN MOVED TO THE NETWORK RECEIVE
                   BUFFER AND THE APPROPRIATE POINTERS AND SEMAPHORES SET ACCORDINGLY.

              OUTPUT - A DATAGRAM MOVED INTO THE NETWORK RECEIVE PORT WITH THE APPROPRIATE
                   POINTER AND SEMAPHORE SET.

              INTERFACE - CALLED BY LOOP

              *************************************************************************/
 808   1      SERVICE$LOOP: PROCEDURE(TABLE$PTR, PORT);
 809   2          DECLARE     INDEX   ADDRESS,
                             PORT BYTE,
                             TABLE$PTR ADDRESS,
                             LOOXRX BASED TABLE$PTR (1) BYTE;

 810   2          NTO1RX(NTO1NC + 0) = 0;
```

```
748   4                 SEND$2 = TRUE;
749   4                 OUTPUT(US$P1$DATA) = TR;
750   4                 END;
751   3             IF ((NOT TRTA$2) OR ((TXTR$2 AND RXTA$2) AND
                              ((NOT RXTR$2) AND (NOT TXTA$2)))) THEN
752   3                 DO;
753   4                 CALL SNDSEQ(.TP$4, SIZE(TP$4));
754   4                 SEND$2 = TRUE;
755   4                 DISABLE;
756   4                 OUTPUT(IC$PORTB) = INPUT(IC$PORTB) AND 0F7H;
757   4                 ENABLE;
758   4                 END;
759   3             END;

760   2          DISABLE;
761   2          OUTPUT(IC$PORTB) = (INPUT(IC$PORTB) AND 0FBH) OR 10H;
762   2          ENABLE;

763   2          IF (((TX03NE - TX03NS) >= DATA$GRAM$SIZE) OR (TX03NS > TX03NE)) AND
                       (NOT SEND$3) THEN
764   2             DO;
765   3             CALL SNDSEQ(.TP$2, SIZE(TP$2));
766   3             IF (TRTA$3 AND (((NOT TXTR$3) AND (NOT RXTA$3)) AND
                              ((NOT RXTR$3) AND (NOT TXTA$3)))) THEN
767   3                DO;
768   4                CALL SNDSEQ(.TP$3, SIZE(TP$3));
769   4                TXTR$3 = TRUE;
770   4                SEND$3 = TRUE;
771   4                OUTPUT(US$P2$DATA) = TR;
772   4                END;
773   3             IF ((NOT TRTA$3) OR ((TXTR$3 AND RXTA$3) AND
                              ((NOT RXTR$3) AND (NOT TXTA$3)))) THEN
774   3                DO;
775   4                CALL SNDSEQ(.TP$4, SIZE(TP$4));
776   4                SEND$3 = TRUE;
777   4                DISABLE;
778   4                OUTPUT(IC$PORTB) = INPUT(IC$PORTB) AND 0DFH;
779   4                ENABLE;
780   4                END;
781   3             END;

782   2          DISABLE;
783   2          OUTPUT(IC$PORTB) = (INPUT(IC$PORTB) AND 0EFH) OR 40H;
784   2          ENABLE;

785   2          IF (((TX04NE - TX04NS) >= DATA$GRAM$SIZE) OR (TX04NS > TX04NE)) AND
                       (NOT SEND$4) THEN
786   2             DO;
787   3             CALL SNDSEQ(.TP$2, SIZE(TP$2));
788   3             IF (TRTA$4 AND (((NOT TXTR$4) AND (NOT RXTA$4)) AND
                              ((NOT RXTR$4) AND (NOT TXTA$4)))) THEN
```

```
                    IS PRESENT TO SEND TO THE LOCAL HOST.  THE INTERRUPT MASKS ARE
                    MASKED OFF  AND MASKED ON BY THE TRANSMIT INTERRUPT ROUTINE AT THE
                    END OF SENDING A PACKET.

                INTERFACE - THIS PROCEDURE IS CALLED IN AN ENDLESS LOOP BY THE
                    MAIN PROGRAM.

                ***************************************************************************/

715   1     ROUTE$OUT:  PROCEDURE;

716   2         DISABLE;
717   2         OUTPUT(IC$PORTB) = INPUT(IC$PORTB) OR 1;
718   2         ENABLE;

719   2         IF (((TX01NE - TX01NS) >= DATA$GRAM$SIZE) OR (TX01NS > TX01NE)) AND
                      (NOT SEND$1) THEN
720   2             DO;
721   3             CALL SNDSEQ(.TP$2, SIZE(TP$2));
722   3             IF (TRTA$1 AND (((NOT TXTR$1) AND (NOT RXTA$1)) AND
                            ((NOT RXTR$1) AND (NOT TXTA$1)))) THEN
723   3                 DO;
724   4                 CALL SNDSEQ(.TP$3, SIZE(TP$3));
725   4                 TXTR$1 = TRUE;
726   4                 SEND$1 = TRUE;
727   4                 OUTPUT(US$PO$DATA) = TR;
728   4                 END;
729   3             IF ((NOT TRTA$1) OR ((TXTR$1 AND RXTA$1) AND
                            ((NOT RXTR$1) AND (NOT TXTA$1)))) THEN
730   3                 DO;
731   4                 CALL SNDSEQ(.TP$4, SIZE(TP$4));
732   4                 SEND$1 = TRUE;
733   4                 DISABLE;
734   4                 OUTPUT(IC$PORTB) = INPUT(IC$PORTB) AND 0FDH;
735   4                 ENABLE;
736   4                 END;
737   3             END;

738   2         DISABLE;
739   2         OUTPUT(IC$PORTB) = (INPUT(IC$PORTB) AND 0FEH) OR 4;
740   2         ENABLE;

741   2         IF (((TX02NE - TX02NS) >= DATA$GRAM$SIZE) OR (TX02NS > TX02NE)) AND
                      (NOT SEND$2) THEN
742   2             DO;
743   3             CALL SNDSEQ(.TP$2, SIZE(TP$2));
744   3             IF (TRTA$2 AND (((NOT TXTR$2) AND (NOT RXTA$2)) AND
                            ((NOT RXTR$2) AND (NOT TXTA$2)))) THEN
745   3                 DO;
746   4                 CALL SNDSEQ(.TP$3, SIZE(TP$3));
747   4                 TXTR$2 = TRUE;
```

```
690   4                    IF LSEM$4 = DONE THEN
691   4                        CALL SEND$PACKET(.LC04RX(LC04NS), 4);
692   4                    END;
                         ELSE
693   3                    DO;
694   4                    STATTB(L$RI$DEST$ERR) = STATTB(L$RI$DEST$ERR) + 1;
695   4                    END;
696   3              CALL SRVC$TAB$HSKP(4);
697   3              END;

698   2          IF NSEM$1 = READY THEN
699   2              DO;
700   3              DESTINATION$ADDRESS = DET$ADDR$NL(.NETR1(0));
701   3              IF DESTINATION$ADDRESS >= 0 THEN
702   3                  CALL MOVETO$LOCAL(.NETR1(5), DESTINATION$ADDRESS);
703   3              NSEM$1 = DONE;
704   3              CALL SRVC$TAB$HSKP(9);  /* FOR SIMULATION ONLY */
705   3              END;

706   2          IF NSEM$2 = READY THEN
707   2              DO;
708   3              DESTINATION$ADDRESS = DET$ADDR$NL(.NETR2(0));
709   3              IF DESTINATION$ADDRESS >= 0 THEN
710   3                  CALL MOVETO$LOCAL(.NETR2(5), DESTINATION$ADDRESS);
711   3              NSEM$2 = DONE;
712   3              CALL SRVC$TAB$HSKP(10); /* FOR SIMULATION ONLY */
713   3              END;

714   2      END ROUTE$IN;

                /*************************************************************************
                PROCEDURE ROUTE$OUT       DETECT WHEN DATAGRAMS ARE PRESENT IN THE
                        LOCAL HOST TRANSMIT BUFFERS AND PROCESSES FOR TRANSMISSION.

                PURPOSE OF THIS PROCEDURE IS TO TRANSMIT DATAGRAMS TO THE LOCAL HOSTS
                     THE TRANSMIT REQUEST/TRANSMIT (TRTA) ACKNOWLEDGE ARRANGEMENT IS
                     INCORPORATED.

                INPUT - DATAGRAMS IN THE LOCAL HOST TRANSMIT BUFFERS.

                PROCESSING - THE RECEIVE INTERRUPT IS MASKED OFF BEFORE CHECKING THE
                     TRANSMIT BUFFER POINTERS (REQUIRED TO HAVE STABLE TABLE POINTERS)
                     WHEN A DATAGRAM IS PRESENT AND THE UNID IS NOT OTHERWISE SENDING
                     A DATAGRAM TO A PARTICULAR HOST, THE TRTA FLAGS ARE CHECK FOR THE
                     ALLOWABLE STATES.  WHEN THE TRTA STATES ARE CORRECT, A TR IS SEND
                     TO THE LOCAL HOST TO INDICATE THE UNID IS READY TO TRANSMIT TO THE
                     HOST.  WHEN A TA IS RECEIVED FROM THE LOCAL HOST, THE TRANSMIT
                     INTERRUPT MASK IS TURNED ON FOR THE PARTICULAR LOCAL HOST PORT
                     AND THE DATAGRAM SENT VIA THE TRANSMIT INTERRUPT ROUTINES.

                OUTPUT - THE TRTA BOOLEAN FLAGS ARE SET APPROPRIATELY WHEN A DATAGRAM
```

```
649   3              CALL DET$ADDR(.LC02RX(LC02NS + 5));
650   3              IF DESTINATION = 0 THEN
651   3                  DO;
652   4                  CALL MOVETO$LOCAL(.LC02RX(LC02NS + 5), (DESTINATION$ADDRESS AND
                                                              0FH));
653   4                  END;
                     ELSE
654   3                  IF DESTINATION = 1 THEN
655   3                     DO;
656   4                     IF LSEM$2 = DONE THEN
657   4                        CALL SEND$PACKET(.LC02RX(LC02NS), 2);
658   4                     END;
                        ELSE
659   3                     DO;
660   4                     STATTB(L$RI$DEST$ERR) = STATTB(L$RI$DEST$ERR) + 1;
661   4                     END;
662   3              CALL SRVC$TAB$HSKP(2);
663   3              END;

664   2           IF (((LC03NE - LC03NS) >= DATA$GRAM$SIZE) OR (LC03NS > LC03NE)) THEN
665   2                DO;
666   3                CALL DET$ADDR(.LC03RX(LC03NS + 5));
667   3                IF DESTINATION = 0 THEN
668   3                    DO;
669   4                    CALL MOVETO$LOCAL(.LC03RX(LC03NS + 5), (DESTINATION$ADDRESS AND
                                                              0FH));
670   4                    END;
                       ELSE
671   3                    IF DESTINATION = 1 THEN
672   3                       DO;
673   4                       IF LSEM$3 = DONE THEN
674   4                          CALL SEND$PACKET(.LC03RX(LC03NS), 3);
675   4                       END;
                          ELSE
676   3                       DO;
677   4                       STATTB(L$RI$DEST$ERR) = STATTB(L$RI$DEST$ERR) + 1;
678   4                       END;
679   3                CALL SRVC$TAB$HSKP(3);
680   3                END;

681   2           IF (((LC04NE - LC04NS) >= DATA$GRAM$SIZE) OR (LC04NS > LC04NE)) THEN
682   2                DO;
683   3                CALL DET$ADDR(.LC04RX(LC04NS + 5));
684   3                IF DESTINATION = 0 THEN
685   3                    DO;
686   4                    CALL MOVETO$LOCAL(.LC04RX(LC04NS + 5), (DESTINATION$ADDRESS AND
                                                              0FH));
687   4                    END;
                       ELSE
688   3                    IF DESTINATION = 1 THEN
689   3                       DO;
```

```
 77   1      VALID$HEX: PROCEDURE(H) BYTE;
 78   2          DECLARE (H,I) BYTE;

 79   2          DO I = 0 TO LAST(ASCII);
 80   3              IF H = ASCII(I) THEN
 81   3                  RETURN TRUE;
 82   3          END;
 83   2          RETURN FALSE;

 84   2      END VALID$HEX;

              /*************************************************************************/
              /*                                                                       */
              /* PROCEDURE    INIT    INITIALIZES THE SOFTWARE VARIABLES               */
              /*                                                                       */
              /*   THE PURPOSE OF THIS PROCEDURE IS TO INITIALIZE THE DATA TABLES      */
              /*   AND OTHER VARIABLES.                                                */
              /*                                                                       */
              /*   INPUT - NONE                                                        */
              /*   PROCESSING - SETS THE VARIABLES TO THEIR INITIAL VALUES.            */
              /*        INITIALIZES THE CP/M USART PORT VARIABLES.                     */
              /*   OUTPUT - INITIALIZED DATA TABLES AND VARIABLES                      */
              /*   INTERFACE - CALLED BY MAIN PROGRAM                                  */
              /*                                                                       */
              /*************************************************************************/
 85   1      INIT: PROCEDURE;

 86   2          MSGNUM = 0;
 87   2          BYTES$SENT$1 = 0;
 88   2          BYTES$RECV$1 = 0;
 89   2          CHAN$NUM = 0;
 90   2          DEST$NET$CODE = 0;
 91   2          BUFFER(0) = 120;
 92   2          CHAR = ' ';
 93   2          TRANS$1$RDY = FALSE;
 94   2          RXTA$TRIES = 0;
 95   2          TRTA, TXTR, TXTA, RXTR, RXTA = FALSE;

 96   2          RX01NS = 0;
 97   2          RX01NE = 0;
 98   2          RX01SZ = DATA$TABLE$SIZE;

 99   2          TX01NS = 0;
100   2          TX01NE = 0;
101   2          TX01SZ = DATA$TABLE$SIZE;

102   2          CALL SINIT;
103   2          CALL SCLROM;

104   2      END INIT;
```

```
                /*****************************************************************/
                /*  PROCEDURE   SNDSEQ   SENDS DATA TO LOCAL MONITOR FOR TESTING  */
                /*                                                               */
                /*   THIS PROCEDURE TAKES A MESSAGE STRING AND OUTPUTS IT TO     */
                /*   THE CP/M SYSTEM                                             */
                /*                                                               */
                /*   INPUT - A POINTER TO THE MESSAGE LOCATION IN MEMORY AND THE */
                /*         NUMBER OF BYTES TO BE SENT.                           */
                /*   PROCESSING - THIS PROCEDURE CHECKS THE OUTPUT BUFFER STATUS  */
                /*         IN A LOOP UNTIL THE BUFFER IS EMPTY. IT CALLS THE CP/M */
                /*         BDOS FUNCTION 2 UNTIL THE COUNT IS ZERO.              */
                /*   OUTPUT - MESSAGE TO THE HOST CP/M SYSTEM.                   */
                /*   INTERFACE - THIS PROCEDURE IS CALLED BY THE FOLLOWING PROCEDURES: */
                /*       ROUTE$IN, ROUTE$OUT, AND MAIN.                          */
                /*                                                               */
                /*****************************************************************/

105   1         SNDSEQ: PROCEDURE(MSG, TOTAL) REENTRANT;
106   2             DECLARE  MSG  ADDRESS,
                           CHAROUT BASED MSG (1) BYTE,
                           (TOTAL, COUNT)   BYTE;

107   2                 COUNT = 0;
108   2                 DO WHILE COUNT < TOTAL;
109   3                     RESULT = BDOS(BDOS2, CHAROUT(COUNT));
110   3                     COUNT = COUNT + 1;
111   3                 END;

112   2         END SNDSEQ;

                /*****************************************************************
                *   READ    PROCEDURE   READS THE CP/M CONSOLE THROUGH BDOS CALL 10  *
                *                                                                    *
                *   INPUT- BDOS FUNCTION 10, A POINTER TO A BUFFER                   *
                *                                                                    *
                *   OUTPUT- CONTENTS OF THE BUFFER FILLED WITH CONSOLE INPUT.        *
                *         I/O ERROR RESULT IN THE VARIABLE RESULT.                   *
                *****************************************************************/

113   1         READ: PROCEDURE;

114   2             RESULT = BDOS(BDOS10, .BUFFER(0));

115   2         END READ;

                /*****************************************************************/
                /*                                                               */
                /*  PROCEDURE  RCV$1   RECEIVES DATA                             */
                /*                                                               */
                /*   THE PURPOSE OF THIS PROCEDURE IS TO TAKE A CHARACTER AT A TIME */
```

```
                /*   FROM THE RECEIVE PORT ONE AND PUT IT IN THE RECEIVE BUFFER.          */
                /*   THE SECOND PART RECEIVES A DATAGRAM IN TOTAL AND PUTS IT INTO        */
                /*   THE RECEIVE BUFFER. A TIMER IS USED TO KEEP THE ROUTINE FROM         */
                /*   HANGING UP .                                                         */
                /*                                                                        */
                /*   INPUT - NONE                                                         */
                /*   PROCESSING - MOVES A BYTE OF DATA FROM THE RECEIVE CHARACTER         */
                /*        ROUTINE IN THE ASSEMBLY LANGUAGE PROGRAM INTO THE RECEIVE       */
                /*        BUFFER.                                                         */
                /*   OUTPUT - RECEIVED DATAGRAM IN THE RECEIVE BUFFER.                    */
                /*   INTERFACE - EXTERNAL CALL TO ASSEMBLY LANGUAGE PROGRAM.              */
                /*                                                                        */
                /**************************************************************************/
                /* USE THIS CODE FOR SELF TEST; CHAR BY CHAR RECEIVE */
                /*
                RCV$1: PROCEDURE;

                    RX01TB(RX01NE) = SCMIN;
                    RX01NE = RX01NE + 1;
                    IF(RX01NE >= RX01SZ) THEN
                        RX01NE = 0;

                END RCV$1;
                */
                /* USE THE FOLLOWING FOR OPERATIONAL 544 S/W TEST */
                /*      DATAGRAM BY DATAGRAM RECEIVE     */

116   1         RCV$1: PROCEDURE;
117   2             DECLARE COUNT ADDRESS;

118   2             COUNT = 30000;
119   2             DO WHILE ((SCMCHK = 0) AND (COUNT <> 0));
120   3                 COUNT = COUNT - 1;
121   3             END;
122   2             IF COUNT = 0 THEN
123   2                 DO;
124   3                 CALL SNDSEQ(.MSG8, SIZE(MSG8));
125   3                 RXTR = FALSE;
126   3                 TXTA = FALSE;
127   3                 END;
                    ELSE
128   2                 IF ((NOT TRTA) OR (RXTR AND TXTA AND
                              (NOT TXTR) AND (NOT RXTA))) THEN
129   2                     DO;
130   3                     DO WHILE (BYTES$RECV$1 < DATA$GRAM$SIZE);
131   4                         RX01TB(RX01NE) = SCMIN;
132   4                         RX01NE = RX01NE + 1;
133   4                         BYTES$RECV$1 = BYTES$RECV$1 + 1;
134   4                     END;
135   3                     BYTES$RECV$1 = 0;
136   3                     IF (RX01NE >= RX01SZ) THEN
```

```
137   3                    RX01NE = 0;
138   3                RXTR = FALSE;
139   3                TXTA = FALSE;
140   3                END;

          END RCV$1;

          /*************************************************************************/
          /*                                                                       */
          /*  PROCEDURE  TRANS$1   TRANSMITS DATA                                  */
          /*                                                                       */
          /*   THE PURPOSE OF THIS PROCEDURE IS TO TAKE A CHARACTER AT A TIME      */
          /*   FROM THE TRANSMIT BUFFER AND SEND IT TO CP/M HOST TRANSMIT USART.   */
          /*   THE SECOND PART TRANSMITS A DATAGRAM IN TOTAL .                     */
          /*                                                                       */
          /*   INPUT - A DATAGRAM IN THE TRANSMIT BUFFER.                          */
          /*   PROCESSING - MOVES A BYTE OF DATA FROM THE TRANSMIT BUFFER          */
          /*        TO THE TRANSMIT CHARACTER ROUTINE IN THE ASSEMBLY LANGUAGE     */
          /*         PROGRAM .                                                     */
          /*   OUTPUT - UPDATED ARRAY POINTERS                                     */
          /*   INTERFACE - EXTERNAL CALL TO ASSEMBLY LANGUAGE PROGRAM.             */
          /*                                                                       */
          /*************************************************************************/
          /* USE THIS CODE FOR SELF TEST; CHAR BY CHAR TRANSMIT */
          /*
          TRANS$1: PROCEDURE;

              IF(BYTES$SENT$1 < DATA$GRAM$SIZE) THEN
                  DO;
                  CALL SCMOUT(TX01TB(TX01NS));
                  BYTES$SENT$1 = BYTES$SENT$1 + 1;
                  TX01NS = TX01NS + 1;

                  IF BYTES$SENT$1 >= DATA$GRAM$SIZE THEN
                      DO;
                      BYTES$SENT$1 = 0;
                      IF TX01NS >= TX01SZ THEN
                          TX01NS = 0;
                      TRANS$1$RDY = FALSE;
                      END;
                  END;

          END TRANS$1;
          */
          /* USE THE FOLLOWING FOR OPERATIONAL 544 S/W TEST */
          /*        DATAGRAM BY DATAGRAM TRANSMIT        */

142   1   TRANS$1: PROCEDURE;

143   2       DO;
144   3       DO WHILE (BYTES$SENT$1 < DATA$GRAM$SIZE);
```

```
145   4             CALL SCMOUT(TX01TB(TX01NS));
146   4             BYTES$SENT$1 = BYTES$SENT$1 + 1;
147   4             TX01NS = TX01NS + 1;
148   4         END;
149   3         BYTES$SENT$1 = 0;
150   3         IF TX01NS >= TX01SZ THEN
151   3             TX01NS = 0;
152   3         TRANS$1$RDY = FALSE;
153   3         TXTR = FALSE;
154   3         RXTA = FALSE;
155   3         END;

156   2     END TRANS$1;

            /*************************************************************************
            PROCEDURE  LD$TAB$HSKP     LOAD TABLE HOUSEKEEP

            THE PURPOSE OF THIS PROCEDURE IS TO HOUSEKEEP A SPECIFIED BUFFER
            TABLE AFTER LOADING OF THE USER DATA FROM THE HOST.

            INPUT - THE INPUT IS AN ADDRESS INDICATING THE TABLE REQUIRING
                 CHANGES.

            PROCESSING - THE PROCEDURE DETERMINES THE TABLE TO BE PROCESSED,
                 ADVANCES THE NEXT$EMPTY$BYTE ADDRESS BY ONE DATA$GRAM$SIZE,
                 AND ADJUSTS FOR BUFFER WRAP IF NECESSARY.

            OUTPUT - THE SPECIFIED TABLE HAS ITS NEXT$EMPTY$BYTE ADDRESS
                 ADVANCED BY THE LENGTH OF A SINGLE DATAGRAM.

            INTERFACE - THIS PROCEDURE IS CALLED BY PROCEDURE ROUTE$IN AND ROUTE$OUT.

            *************************************************************************/
157   1     LD$TAB$HSKP: PROCEDURE(TABLE) ;
158   2           DECLARE  TABLE ADDRESS;

159   2           TX01NE = TX01NE + DATA$GRAM$SIZE;
160   2           IF TX01NE >= TX01SZ THEN
161   2               TX01NE = 0;

162   2     END LD$TAB$HSKP;

            /*************************************************************************
            PROCEDURE   SRVC$TAB$HSKP       SERVICE TABLE HOUSEKEEP

            THE PURPOSE OF THIS PROCEDURE IS TO HOUSEKEEP A SPECIFIED
                 BUFFER TABLE AFTER SERVICING (REMOVING A PACKET).

            INPUT - THE INPUT IS AN ADDRESS VALUE INDICATING THE TABLE THAT
                 REQUIRES HOUSEKEEPING.
```

```
                PROCESSING - THE PROCEDURE DETERMINES THE TABLE TO BE PROCESSED,
                     ADVANCES THE NEXT$BYTE$TO$BE$SERVICED ADDRESS BY A DATA$GRAM$SIZE.
                     AND ADJUSTS FOR BUFFER WRAP IF NECESSARY.

                OUTPUT - THE SPECIFIED TABLE HAS ITS NEXT$BYTE$TO$BE$SERVICED ADDRESS
                     ADVANCED BY THE LENGTH OF A SINGLE DATAGRAM.

                INTERFACE - THIS PROCEDURE IS CALLED BY PROCEDURE ROUTE$IN AND ROUTE$OUT.

                ************************************************************************/

163   1     SRVC$TAB$HSKP: PROCEDURE(TAB) ;
164   2         DECLARE  TAB  ADDRESS;

165   2         DO CASE TAB;
166   3             ;

167   3             DO;
168   4             RX01NS = RX01NS + DATA$GRAM$SIZE;
169   4             IF RX01NS >= RX01SZ THEN
170   4                 RX01NS = 0;
171   4             END;

172   3             DO;
173   4             TX01NS = TX01NS + DATA$GRAM$SIZE;
174   4             IF TX01NS >= TX01SZ THEN
175   4                 TX01NS = 0;
176   4             END;

177   3         END;

178   2     END SRVC$TAB$HSKP;

                /************************************************************************
                PROCEDURE   CHK$RXTA     CHECK FOR RECEIVED TRANSMIT ACK

                THE PURPOSE OF THIS PROCEDURE IS TO CHECK THE RECEIVED CP/M PORT FOR A
                     RECEIVED TRANSMIT ACK FROM THE UNID II. A TIMER IS USED TO KEEP
                     THE PROGRAM FROM HANGING UP IN THIS ROUTINE.

                INPUT - THE INPUT IS THE FOUR TRTA BOOLEAN FLAGS .

                PROCESSING - THE PROCEDURE WILL ONLY EXECUTE IF THE FOUR TRTA BOOLEAN FLAGS
                     ARE IN THE CORRECT STATES.  WHEN THEY ARE, THE PROCEDURE INITIALIZES
                     THE TIMECOUNTER AND WAITS FOR A RECEIVED TA FROM THE UNID TO AN EARLIER
                     TRANSMITTED TR TO THE UNID.  IF THE TIMER TIMES OUT, THE BOOLEAN IS
                     RESET AND A TIMOUT MESSAGE IS DISPLAYED.  WHEN THE TA IS RECEIVED
                     BEFORE THE TIMOUT, THE PROCEDURE SETS THE BOOLEAN FLAGS ACCORDINGLY
                     AND SENDS THE DATAGRAM TO THE UNID II.

                OUTPUT - A DATAGRAM TO THE UNID II OR RESET BOOLEAN FLAGS.
```

```
                INTERFACE - THIS PROCEDURE IS CALLED BY PROCEDURE ROUTE$IN AND ROUTE$OUT.

                ************************************************************************/
179   1         CHK$RXTA: PROCEDURE;
180   2             DECLARE COUNT ADDRESS;

181   2             IF (TXTR AND (NOT RXTA) AND (NOT RXTR) AND (NOT TXTA)) THEN
182   2                 COUNT = 30000;
183   2                 DO WHILE ((SCMCHK = 0) AND (COUNT <> 0));
184   3                     COUNT = COUNT - 1;
185   3                 END;
186   2                 IF COUNT = 0 THEN
187   2                     DO;
188   3                     CALL SNDSEQ(.MSG9, SIZE(MSG9));
189   3                     TXTR = FALSE;
190   3                     END;
                        ELSE
191   2                     DO;
192   3                     CHAR = SCMIN;
193   3                     IF CHAR = TA THEN
194   3                         DO;
195   4                         CALL SNDSEQ(.TP$60, SIZE(TP$60));
196   4                         RXTA = TRUE;
197   4                         RXTA$TRIES = 0;
198   4                         CALL TRANS$1;
199   4                         END;
200   3                     END;

201   2         END CHK$RXTA;

                /************************************************************************
                PROCEDURE   CHK$RXTR     CHECK FOR RECEIVED TRANSMIT REQUEST

                THE PURPOSE OF THIS PROCEDURE IS TO CHECK THE RECEIVED CP/M PORT FOR A
                     RECEIVED TRANSMIT REQUEST FROM THE UNID II. A TIMER IS USED TO KEEP
                     THE PROGRAM FROM HANGING UP IN THIS ROUTINE.

                INPUT - THE INPUT IS THE FOUR TRTA BOOLEAN FLAGS .

                PROCESSING - THE PROCEDURE WILL ONLY EXECUTE IF THE FOUR TRTA BOOLEAN FLAGS
                     ARE IN THE CORRECT STATES.  WHEN THEY ARE, THE PROCEDURE INITIALIZES
                     THE TIMECOUNTER AND WAITS FOR A RECEIVED TR FROM THE UNID. IF THE TIMER
                     TIMES OUT, THE BOOLEAN IS RESET AND A TIMOUT MESSAGE IS DISPLAYED.
                     WHEN THE TR IS RECEIVED BEFORE THE TIMOUT, THE PROCEDURE SETS THE
                     BOOLEAN FLAGS ACCORDINGLY AND SENDS FIRST A TA AND THEN WAITS FOR A
                     DATAGRAM FROM THE UNID II.

                OUTPUT - A TA AND A DATAGRAM FROM THE UNID II OR RESET BOOLEAN FLAGS.

                INTERFACE - THIS PROCEDURE IS CALLED BY PROCEDURE ROUTE$IN AND ROUTE$OUT.
```

```
                ************************************************************************/
202   1         CHK$RXTR: PROCEDURE;
203   2             DECLARE COUNT ADDRESS;

204   2             IF ((NOT RXTR) AND (NOT TXTA) AND (NOT TXTR) AND (NOT RXTA)) THEN
205   2                 COUNT = 30000;
206   2                 DO WHILE ((SCMCHK = 0) AND (COUNT <> 0));
207   3                     COUNT = COUNT - 1;
208   3                 END;
209   2                 IF COUNT = 0 THEN
210   2                     CALL SNDSEQ(.MSG10, SIZE(MSG10));
                        ELSE
211   2                     DO;
212   3                     CHAR = SCMIN;
213   3                     IF CHAR = TR THEN
214   3                         DO;
215   4                         CALL SNDSEQ(.TP$59, SIZE(TP$59));
216   4                         CALL SNDSEQ(.TP$58, SIZE(TP$58));
217   4                         RXTR = TRUE;
218   4                         TXTA = TRUE;
219   4                         CALL SCMOUT(TA);
220   4                         CALL RCV$1;
221   4                         END;
222   3                     END;

223   2         END CHK$RXTR;

                /************************************************************************
                PROCEDURE READ$TXTAB     PROCEDURE TO READ A DATAGRAM IN THE TRANSMIT TABLE

                INPUT - THE TRANSMIT TABLE POINTERS AND RETRIES COUNT

                PROCESSING - THE PROCEDURE CHECKS THE NUMBER OF ATTEMPTS TO SEND THE DATA
                     GRAM IN THE TRANSMIT BUFFER.  IF THE NUMBER OF TIMES EXCEEDS THE
                     MAXIMUM, THEN THE COUNTER AND TRTA FLAGS ARE RESET.  THE TRANSMIT
                     BUFFER IS THEN CHECKED TO DETERMINE IF A DATAGRAM IS PRESENT IN
                     THE TRANSMIT BUFFER. WHEN A DATAGRAM IS PRESENT, THE MESSAGE AND IT'S
                     IP HEADER IS DISPLAYED ON THE CP/M CONSOLE.  IF THE TRTA FLAGS ARE
                     IN THE CORRECT STATE, THEN A TR IS SEND TO THE UNID II AND THE FLAGS
                     ARE SET TO INDICATE A DATAGRAM IS READY TO BE SENT.

                OUTPUT - THE TRANSMIT DATAGRAM AND IP HEADER ARE DISPLAYED ON THE CP/M
                     CONSOLE.

                INTERFACE - THIS PROCEDURE IS CALLED BY THE MAIN PROGRAM.

                ************************************************************************/

224   1         READ$TXTAB: PROCEDURE;
225   2             DECLARE I BYTE;
```

```
226   2          RXTA$TRIES = RXTA$TRIES + 1;
227   2          IF RXTA$TRIES > MAX$RXTA$TRIES THEN
228   2              DO;
229   3              TXTR = FALSE;
230   3              RXTA = FALSE;
231   3              CALL SRVC$TAB$HSKP(2);
232   3              RXTA$TRIES = 0;
233   3              END;

234   2          IF ((TX01NE - TX01NS) >= DATA$GRAM$SIZE) OR (TX01NS > TX01NE) THEN
235   2              DO;
236   3              I = 12;
237   3              DO WHILE I <= 19;
238   4                  CALL HEX$ASC(TX01TB(TX01NS + I),(I-12)*2);
239   4                  I = I + 1;
240   4              END;
241   3              CALL SNDSEQ(.TP$55A, SIZE(TP$55A));
242   3              CALL SNDSEQ(.CRLF, SIZE(CRLF));
243   3              CALL SNDSEQ(.TEMP1, SIZE(TEMP1));
244   3              CALL SNDSEQ(.TX01TB(TX01NS + 56), TCP$DATA$SIZE);
245   3              IF (TRTA AND (NOT TXTR) AND (NOT RXTA) AND
                           (NOT RXTR) AND (NOT TXTA)) THEN
246   3                  DO;
247   4                  TXTR = TRUE;
248   4                  CALL SNDSEQ(.TP$57, SIZE(TP$57));
249   4                  CALL SCMOUT(TR);
250   4                  END;
251   3              IF (NOT TRTA) THEN
252   3                  TRANS$1$RDY = TRUE;
253   3          END;
254   2      END READ$TXTAB;

              /*************************************************************************
              PROCEDURE READ$TXTAB     PROCEDURE TO READ A DATAGRAM IN THE RECEIVE TABLE

              INPUT - THE TRANSMIT TABLE POINTERS

              PROCESSING - THE PROCEDURE CHECKS THE RECEIVE BUFFER TO DETERMINE IF A
                   DATAGRAM IS PRESENT IN THE RECEIVE BUFFER.  WHEN A DATAGRAM IS
                   PRESENT, THE RECEIVED MESSAGE IS DISPLAYED ON THE CP/M CONSOLE.
                   THE IP HEADER IS ALSO DISPLAYED.  THE RECEIVED TABLE POINTERS ARE
                   UPDATED.

              OUTPUT - THE RECEIVED DATAGRAM AND ITS HEADER ARE DISPLAYED ON THE CP/M
                   CONSOLE.

              INTERFACE - THIS PROCEDURE IS CALLED BY THE MAIN PROGRAM.

              *************************************************************************/
255   1      READ$RXTAB: PROCEDURE;
```

```
256   2          DECLARE I BYTE;

257   2          IF ((RX01NE - RX01NS) >= DATA$GRAM$SIZE) OR (RX01NS > RX01NE) THEN
258   2              DO;
259   3              I = 12;
260   3              DO WHILE I <= 19;
261   4                  CALL HEX$ASC(RX01TB(RX01NS + I),(I-12)*2);
262   4                  I = I + 1;
263   4              END;
264   3              CALL SNDSEQ(.TP$56A, SIZE(TP$56A));
265   3              CALL SNDSEQ(.CRLF, SIZE(CRLF));
266   3              CALL SNDSEQ(.TEMP1, SIZE(TEMP1));
267   3              CALL SNDSEQ(.RX01TB(RX01NS + 56), TCP$DATA$SIZE);
268   3              CALL SRVC$TAB$HSKP(1);
269   3          END;

270   2      END READ$RXTAB;

              /*************************************************************************
              PROCEDURE LOAD     LOADS A DATAGRAM INTO THE TX01TB TABLE.

              THE PURPOSE OF THIS PROCEDURE IS TO LOAD A TEST DATAGRAM INTO THE TRANSMIT
                   TABLE FOR TRANSMISSION TO THE UNID #1.

              INPUT - A POINTER TO THE NEXT AVAILABLE SPACE IN THE TRANSMIT TABLE, THE
                   DESTINATION UNID NUMBER AND THE DESTINATION HOST NUMBER.

              PROCESSING - A DATAGRAM IS INITIALIZED TO ZEROS, THEN THE APPROPRIATE
                   CONSTANTS INSERTED INTO THE HEADER, ALONG WITH THE DESTINATION UNID
                   AND HOST NUMBERS, AND THE TEST MESSAGE WITH A MODULO 10 NUMBER,
                   INSERTED AT THE CURRENT TABLE$PTR.

              OUTPUT - A COMPLETED DATAGRAM AT THE CURRENT TABLE$PTR IN THE TRANSMIT
                   TABLE

              INTERFACE - CALLED BY READ$LINE

              *************************************************************************/

271   1      LOAD: PROCEDURE(TABLE$PTR, DEST$UNID, DEST$HOST);

272   2          DECLARE (INDEX, TABLE$PTR) ADDRESS;
273   2          DECLARE (DEST$UNID, DEST$HOST) BYTE;
274   2          DECLARE LCOXTB BASED TABLE$PTR (1) BYTE;

275   2              DO INDEX = 0 TO (DATA$GRAM$SIZE - 1);
276   3                  LCOXTB(INDEX) = 0;
277   3              END;

                  /* VARIOUS CONSTANTS PER THE TCP/IP SPEC */
278   2              LCOXTB(0) = 48H;
```

```
279   2             LCOXTB(3) = 80H;
280   2             LCOXTB(6) = 40H;
281   2             LCOXTB(8) = 30H;
282   2             LCOXTB(9) = 6;
283   2             LCOXTB(20) = 82H;
284   2             LCOXTB(21) = 08H;

                  /* IP SOURCE HEADER */
285   2             LCOXTB( 12) = THIS$COUNTRY$CODE AND 0FH;
                                    /* CT    = 0, CC    = THIS$COUNTRY$CODE */
286   2             LCOXTB( 13) = (ROL(THIS$UNID$NBR, 4) AND 0F0H) OR
                                    (ROR(((CHAN$NUM*56) AND 0F0H), 4) AND 0FH);
                                    /* NC    = THIS$UNID$NBR, HC(H) = CHAN$NUM * 56*/
287   2             LCOXTB( 14) = 7H OR (ROL(((CHAN$NUM*56) AND 0FH), 4) AND 0F0H);
                                    /* HC(L) = CHAN$NUM * 56, PC(2) = 7 */
288   2             LCOXTB( 15) = 77H;  /* PC(1) = 7, PC(0) = 7 */

                  /* IP DESTINATION HEADER */
289   2             LCOXTB( 16) = THIS$COUNTRY$CODE AND 0FH;
                                    /* CT    = 0, CC    = THIS$COUNTRY$CODE */
290   2             LCOXTB( 17) = (ROL(DEST$UNID, 4) AND 0F0H) OR
                                    (ROR((DEST$HOST AND 0F0H), 4) AND 0FH);
                                    /* NC    = DEST$UNID, HC(H) = DEST$HOST */
291   2             LCOXTB( 18) = 7H OR (ROL((DEST$HOST AND 0FH), 4) AND 0F0H);
                                    /* HC(L) = DEST$HOST, PC(2) = 7 */
292   2             LCOXTB( 19) = 77H;  /* PC(1) = 7, PC(0) = 7 */

293   2             CALL MOVE(TOP$DATA$SIZE, .MESSAGE, .LCOXTB( 56));
294   2             IF MSGNUM > 9 THEN
295   2                 MSGNUM = 0;
296   2             LCOXTB( 86) = '0' + MSGNUM;
297   2             MSGNUM = MSGNUM + 1;
298   2             CALL SNDSEQ(.TP$54, SIZE(TP$54));

299   2       END LOAD;

              /*****************************************************************************
              PROCEDURE READ$LINE      INTERPRETS A LINE FROM THE CP/M CONSOLE

              PURPOSE OF THIS PROCEDURE IS TO READ A LINE OF DATA FROM THE HOST CP/M
                   CONSOLE, THEN INTERPRET FOR EXECUTING EITHER LOAD ANOTHER TEST
                   MESSAGE IN THE TRANSMIT TABLE OR STOPPING THE TEST.

              INPUT - INPUT RESPONSES FROM THE CONSOLE OPERATOR.  RESPONSES ARE NUMBER
                   OF DATAGRAMS, DESTINATION UNID, AND DESTINATION HOST.

              PROCESSING - THE CONSOLE OPERATOR'S RESPONSES ARE INTERPRETED AND THE
                   APPROPRIATE NUMBER OF DATAGRAMS ARE LOADED INTO THE TRANSMIT BUFFER.
                   THE OPERATOR ALSO HAS OPPORTUNITY TO END THE TEST.

              OUTPUT - AN OPERATOR SPECIFIED NUMBER OF DATAGRAMS INSERTED INTO THE
```

```
                    TRANSMIT BUFFER.

                INTERFACE - CALLED BY MAIN PROCEDURE

                ************************************************************************/

300   1         READ$LINE: PROCEDURE;

301   2             DECLARE TABLE$PTR ADDRESS,
                          (I, COUNT) BYTE;

302   2             I = 0;

303   2             CALL SNDSEQ(.MSG1, SIZE(MSG1));
304   2             BUFFER(2) = 'N';
305   2             CALL READ;

306   2             IF (BUFFER(2) = 'Y') OR (BUFFER(2) = 'y') THEN
307   2                 DO;
308   3                 CALL SNDSEQ(.MSG1A, SIZE(MSG1A));
309   3                 BUFFER(2) = 'N';
310   3                 CALL READ;
311   3                 IF (BUFFER(2) = 'Y') OR (BUFFER(2) = 'y') THEN
312   3                     TRTA = TRUE;
                      ELSE
313   3                     TRTA = FALSE;
314   3                 CALL SNDSEQ(.MSG3, SIZE(MSG3));
315   3                 CALL READ;
316   3                 CHAN$NUM = ASC$HEX(BUFFER(2));
317   3                 IF (CHAN$NUM >= 1) AND (CHAN$NUM <= 4) THEN
318   3                     DO;
319   4                     TABLE$PTR = .TX01TB(TX01NE);
320   4                     CALL SNDSEQ(.MSG5, SIZE(MSG5));
321   4                     CALL READ;
322   4                     DEST$NET$CODE = ASC$HEX(BUFFER(2));

323   4                     CALL SNDSEQ(.MSG6, SIZE(MSG6));
324   4                     CALL READ;
325   4                     DEST$HOST$CODE = 0;
326   4                     COUNT = BUFFER(1);
327   4                     DO I = 1 TO COUNT;
328   5                         DEST$HOST$CODE = ROL(DEST$HOST$CODE, 4);
329   5                         DEST$HOST$CODE = DEST$HOST$CODE OR ASC$HEX(BUFFER(I+1));
330   5                     END;

331   4                     CALL SNDSEQ(.MSG4, SIZE(MSG4));
332   4                     CALL READ;
333   4                     IF (BUFFER(2) >= '1') AND (BUFFER(2) <= '9') THEN
334   4                         DO I = 1 TO ASC$HEX(BUFFER(2));
335   5                             CALL LOAD(TABLE$PTR, DEST$NET$CODE, DEST$HOST$CODE);
336   5                             CALL LD$TAB$HSKP(2);
```

```
337   5                       TABLE$PTR = .TX01TB(TK01NE);
338   5                   END;
339   4               END;
340   3           END;

341   2           CALL SNDSEQ(.TP$50, SIZE(TP$50));
342   2           CALL HEX$ASC(CHAN$NUM, 0);
343   2           CALL SNDSEQ(.TEMP1, 2);
344   2           CALL SNDSEQ(.TP$51A, SIZE(TP$51A));
345   2           CALL HEX$ASC(DEST$NET$CODE, 0);
346   2           CALL SNDSEQ(.TEMP1, 2);
347   2           CALL SNDSEQ(.TP$52A, SIZE(TP$52A));
348   2           CALL HEX$ASC(DEST$HOST$CODE, 0);
349   2           CALL SNDSEQ(.TEMP1, 2);

350   2           CALL SNDSEQ(.MSG2, SIZE(MSG2));
351   2           BUFFER(2) = 'N';
352   2           CALL READ;

353   2           IF (BUFFER(2) = 'Y') OR (BUFFER(2) = 'y') THEN
354   2               FOREVER = FALSE;
                  ELSE
355   2               FOREVER = TRUE;

356   2       END READ$LINE;

              /*************************************************************************
              PROCEDURE READ$LINE      TRANSMITS AND RECEIVES A DATAGRAM

              PURPOSE OF THIS PROCEDURE IS TO TRANSMIT AND RECEIVE A DATAGRAM TO AND FROM
                   THE UNID II.  THIS PROCEDURE DOES NOT MAKE USE OF THE TRTA HANDSHAKE.
                   INSTEAD, IT TRANSMITS A FULL DATAGRAM TO THE UNID AND THEN WAITS
                   UNTIL THE UNID SENDS A DATAGRAM BACK.  USED TO TEST THE UNID II
                   WITHOUT THE TRTA HANDSHAKE.

              INPUT - DATAGRAM IN THE TRANSMIT BUFFER

              PROCESSING - THE TRANSMIT DATAGRAM AND RECEIVE DATAGRAM PROCEDURES ARE
                   CALLED TO SEND AND RECEIVE A DATAGRAM, RESPECTIVELY.

              OUTPUT - A DATAGRAM IN THE RECEIVE BUFFER.

              INTERFACE - CALLED BY MAIN PROCEDURE

              *************************************************************************/

357   1       LOOP2: PROCEDURE;

359   2           CALL TRANS$1;
359   2           CALL RCV$1;
```

```
PL/M-80 COMPILER  LOCAL NETWORK TEST PROG FOR CP/M MACHINE,  25 SEP 84

 360   2       END LOOP2;

               /*****************************************************************************/
               /*      THIS IS THE MAIN BODY OF THE PROGRAM                                 */
               /*****************************************************************************/

 361   1       BEGIN:

                  CALL INIT;
 362   1          CALL SNDSEQ(.STARTUP$HDR, SIZE(STARTUP$HDR));
 363   1          FOREVER = TRUE;
 364   1          CALL READ$LINE;
 365   1          CALL SCLRCM;
 366   1          DO WHILE FOREVER;
 367   2               CALL READ$TXTAB;
 368   2               IF TRTA THEN
 369   2                   CALL CHK$RXTA;
 370   2               IF TRANS$1$RDY THEN
 371   2                   CALL LOOP2;
 372   2               IF TRTA THEN
 373   2                   CALL CHK$RXTR;
 374   2               CALL READ$RXTAB;
 375   2               IF SCMCHK <> 0 THEN
 376   2                   CALL CHK$RXTR;
 377   2               CALL READ$LINE;
 378   2          END;
 379   1          CALL SNDSEQ(.MSG7, SIZE(MSG7));
 380   1          CALL EXIT;

 381   1       END MAIN;

               /******************************** THE END ********************************/

MODULE INFORMATION:

     CODE AREA SIZE     = 0D61H   3425D
     VARIABLE AREA SIZE = 0AE0H   2784D
     MAXIMUM STACK SIZE = 000CH     12D
     325 LINES READ
     0 PROGRAM ERROR(S)

END OF PL/M-80 COMPILATION
```

5. SBC 544 Monitor

The purpose of this program is to provide a monitor capability on the SBC 544 board. The functions included in this monitor are similar in function and use to CP/M tools DDT.COM and SID.COM. This monitor is adapted from the monitor source code for the SBC 86/12A board. The original monitor cannot be published in this document as it is copyrighted material from Intel. The original source code is available, however, in the Computer Networks Laboratory on an ISIS disk. For information purposes, a similar monitor can be developed for the SBC 88/45 board by starting with the original SBC 86/12A monitor and adapting the I/O port numbers to those on the SBC 88/45 board.

```
ISIS-II 8080/8085 MACRO ASSEMBLER, V4.1

EXTERNAL SYMBOLS


USER SYMBOLS
BDOS    C 000F    BDOSO   A 0005    BIT7    C 040A    BIT3    C 040B    BITS1   C 0317
BITS2   C 0348    BITS7   C 00C6    BITSA   C 00C9    BTBL    C 03F6    CHOIC   C 0398
CLEAR   C 0412    CLRCM   C 011F    CMCHK   C 0122    CMIN    C 0127    CMOUT   C 0131
CNOUTO  C 0025    CONIN   C 0019    CONINO  C 0023    CONOUT  C 001D    CONST   C 0015
CONSTO  C 0021    CR      A 000D    CTSMSK  A 0010    CXRMSK  A 0080    DSRMSK  A 0020
DTRMSK  A 0001    ERROR   A 000E    EVPAR   C 040F    EXIT    C 0012    INBUF   C 0414
INIT    C 0027    INIT1   C 00A1    INIT2   C 0076    INIT3   C 0081    INIT4   C 008C
INITS   C 0046    LF      A 000A    MCTLA   C 0411    MENU    C 0204    MSGS    C 014F
NOPAR   C 040E    ODPAR   C 0410    OTWT    C 0131    PAR     C 037A    PARE    C 0100
PARN    C 00FA    PARX    C 0103    RATE    C 0249    RETURN  C 013B    RTMSK   A 0040
RTSMSK  A 0002    RXRDY   A 0001    SAVIT   C 0094    SCLRCM  C 0003    SCMCHK  C 0006
SCMIN   C 0009    SCMOUT  C 000C    SDATA   A 0020    SIDENT  A 0022    SINIT   C 0000
SINTEN  A 0021    SLCTRL  A 0023    SLSTAT  A 0025    SMDMCT  A 0024    SMDMST  A 0026
START   C 0000    STP1    C 040C    STP2    C 040D    STPA    C 00DD    STPB    C 00E0
TXMTY   A 0020    ULCAS   C 013C    VALNUM  C 0145    WBVEC   A 0000    XOF     A 0013
XON     A 0011

ASSEMBLY COMPLETE,  NO ERRORS
```

```
ISIS-II 8080/8085 MACRO ASSEMBLER, V4.1

                        297 ;
 LOC  OBJ               LINE        SOURCE STATEMENT

 03F6 74                298 BTBL:   DB      1396 MOD 256    ;110 bps
 03F7 05                299         DB      1396/256
 03F8 00                300         DB      1024 MOD 256    ;150
 03F9 04                301         DB      1024/256
 03FA 00                302         DB      512 MOD 256     ;300
 03FB 02                303         DB      512/256
 03FC 00                304         DB      256 MOD 256     ;600
 03FD 01                305         DB      256/256
 03FE 80                306         DB      128 MOD 256     ;1200
 03FF 00                307         DB      128/256
 0400 40                308         DB      64 MOD 256      ;2400
 0401 00                309         DB      64/256
 0402 20                310         DB      32 MOD 256      ;4800
 0403 00                311         DB      32/256
 0404 10                312         DB      16 MOD 256      ;9600
 0405 00                313         DB      16/256
 0406 08                314         DB      8 MOD 256       ;19200
 0407 00                315         DB      8/256
 0408 04                316         DB      4 MOD 256       ;38400
 0409 00                317         DB      4/256
                        318 ;
 040A 02                319 BIT7:   DB      00000010B       ;7 bit mask
 040B 03                320 BIT8:   DB      00000011B       ;8 bit mask
 040C 00                321 STP1:   DB      0               ;1 stop bit
 040D 04                322 STP2:   DB      00000100B       ;2 stop bits
 040E 00                323 NOPAR:  DB      0               ;No parity
 040F 18                324 EVPAR:  DB      00011000B       ;Even parity
 0410 08                325 ODPAR:  DB      00001000B       ;Odd parity
 0411 02                326 MCTLA:  DB      00000010B       ;Modem control default (DTR off,
RTS on)
                        327 ;
 0412 1A                328 CLEAR:  DB      1AH,'$'         ;String to clear screen (Soroc IQ
120)
 0413 24
                        329 ;
 0414 05                330 INBUF:  DB      5       ;Input buffer, max # chars
 0415 00                331         DB      0       ;# chars in buff
 0416                   332         DS      5       ;Storage for chars
                        333 ;
 041B 656E6420          334         DB      'end BBS'
 041F 424253
                        335 ;
                        336         END


PUBLIC SYMBOLS
BOOS    C 000F    CONIN   C 0019    CONOUT C 0010    CONST  C 0015    EXIT   C 0012
GETCOM C 0003    IOMODE C 0006    LOGIN  C 0009    LOGOUT C 000C    SINIT  C 0000
```

```
0361 0A
LOC  OBJ          LINE        SOURCE STATEMENT

                   288 ;
0362 20202064      289         DB      '   d       Parity       '
0366 20202020
036A 20202050
036E 61726974
0372 79202020
0376 20202020
037A 3120          290 PAR:    DB      '1 '
037C 20202020      291         DB      '    1-None, 2-Even, 3-Odd',CR,LF,LF
0380 312D4E6F
0384 6E652020
0388 322D4576
038C 656E2020
0390 332D4F64
0394 64
0395 0D
0396 0A
0397 0A
                   292 ;
0398 53686F77      293 CHOIC:  DB      'Show choice by letter, space or comma, number,
     and CR',CR,LF
039C 2063686F
03A0 69636520
03A4 6279206C
03A8 65747465
03AC 72202073
03B0 70616365
03B4 206F7220
03B8 636F6D6D
03BC 61202C6E
03C0 756D6265
03C4 72202061
03C8 6E642043
03CC 52
03CD 0D
03CE 0A
03CF 48697420      294         DB      'Hit CR when menu selections complete: $'
03D3 43522077
03D7 68656E20
03DB 6D656E75
03DF 2073656C
03E3 65637469
03E7 6F6E7320
03EB 636F6D70
03EF 6C657465
03F3 3A2024
                   295 ;
                   296 ;Rate table for 2.45 MHz xtal
```

```
02D1 0D
LOC  OBJ          LINE        SOURCE STATEMENT

02D2 0A
02D3 20202020      279         DB      '                              9-38.4
     kbps',CR,LF,LF
02D7 20202020
02DB 20202020
02DF 20202020
02E3 20202020
02E7 20202020
02EB 20202020
02EF 2020392D
02F3 33382E34
02F7 206B6270
02FB 73
02FC 0D
02FD 0A
02FE 0A
                   280 ;
02FF 20202062      281         DB      '   b       Data Bits    '
0303 20202020
0307 20202044
030B 61746120
030F 42697473
0313 20202020
0317 3220          282 BITS1:  DB      '2 '
0319 20202020      283         DB      '    1-7 bit, 2-8 bit',CR,LF,LF
031D 312D3720
0321 6269742C
0325 20322D38
0329 20626974
032D 0D
032E 0A
032F 0A
                   284 ;
0330 20202063      285         DB      '   c       Stop Bits    '
0334 20202020
0338 20202053
033C 746F7020
0340 42697473
0344 20202020
0348 3120          286 BITS2:  DB      '1 '
034A 20202020      287         DB      '    1-1 bit, 2-2 bits',CR,LF,LF
034E 312D3120
0352 6269742C
0356 20322D32
035A 20626974
035E 73
035F 0D
0360 0A
```

```
022E 0D
LOC  OBJ          LINE        SOURCE STATEMENT

022F 0A
0230 0A
0231 20202061      274         DB      '   a       Data Rate    '
0235 20202020
0239 20202044
023D 61746120
0241 52617465
0245 20202020
0249 3720          275 RATE:   DB      '7 '
024B 20202020      276         DB      '    0- 110, 1- 150, 2- 300',CR,LF
024F 302D2031
0253 31302C20
0257 312D2031
025B 35302C20
025F 322D2033
0263 3030
0265 0D
0266 0A
0267 20202020      277         DB      '                                3- 600, 4-1200, 5-
                                                2400',CR,LF
026B 20202020
026F 20202020
0273 20202020
0277 20202020
027B 20202020
027F 20202020
0283 2020332D
0287 20363030
028B 2020342D
028F 31323030
0293 2020352D
0297 32343030
029B 0D
029C 0A
029D 20202020      278         DB      '                                6-4800, 7-9600, 8-
    19.2', CR,LF
02A1 20202020
02A5 20202020
02A9 20202020
02AD 20202020
02B1 20202020
02B5 20202020
02B9 2020362D
02BD 34383030
02C1 2C20372D
02C5 39363030
02C9 2C20382D
02CD 31392E32
```

```
018F 77697468
LOC  OBJ          LINE        SOURCE STATEMENT

0193 20746865
0197 20554E49
019B 44204949
019F 20695342
01A3 43203534
01A7 3420496E
01AB 7465726E
01AF 65742050
01B3 726F746F
01B7 636F6C20
01BB 28495029
01BF 0D
01C0 0A
01C1 20202020     269         DB      '    to simulate an actual host system.',CR,LF
01C5 746F2073
01C9 696D756C
01CD 61746520
01D1 616E2061
01D5 63747561
01D9 6C20686F
01DD 73742073
01E1 79737465
01E5 6D2E
01E7 0D
01E8 0A
01E9 48697420     270         DB      'Hit any key to continue $',CR,LF
01ED 616E7920
01F1 6B657920
01F5 746F2063
01F9 6F6E7469
01FD 6E756520
0201 24
0202 0D
0203 0A
                  271 ;
                  272 MENU:
0204 46656174     273         DB      'Feature      Name    Choice
           Option',CR,LF,LF
0208 75726520
020C 20202020
0210 204E616D
0214 65202020
0218 2043686F
021C 69636520
0220 20202020
0224 20202020
0228 4F707469
022C 6F6E
```

```
                        239 ;
LOC  OBJ            LINE        SOURCE STATEMENT

                        240 ; Output byte to remote computer
                        241 ;
                        242 CMOUT:
                        243 OTWT:
0131 DB25               244         IN      SLSTAT  ;Get the transmit status
0133 E620               245         ANI     TXMTY
0135 CA3101     C       246         JZ      OTWT    ;Not ready yet
0138 79                 247         MOV     A,C     ;It is now, send the byte
0139 D320               248         OUT     SDATA
013B C9                 249 RETURN: RET             ;Default return
                        250 ;
013C FE61               251 ULCAS:  CPI     'a'     ;Less than lower case a?
013E F8                 252         RM              ;Yes
013F FE7B               253         CPI     'z'+1   ;> lower case z?
0141 F0                 254         RP              ;Yes
0142 D620               255         SUI     ' '     ;No, clear lower case bit
0144 C9                 256         RET
                        257 ;
0145 FE30               258 VALNUM: CPI     '0'     ;Less than 0?
0147 37                 259         STC
0148 F8                 260         RM              ;Carry set; not valid number
0149 FE3A               261         CPI     ':'     ;More than 9?
014B 37                 262         STC
014C F0                 263         RP              ;Carry set; not valid number
014D 3F                 264         CMC
014E C9                 265         RET             ;Carry cleared; valid number
                        266 ;
014F 1A                 267 MSGS:   DB      1AH,'Configured for the CCS 2810 CPU (at 4 MHz),
     17 Aug 84',CR,LF
0150 436F6E66
0154 69677572
0158 65642066
015C 6F722074
0160 68652043
0164 43532032
0168 38313020
016C 43505520
0170 28617420
0174 34204D48
0178 7A292C20
017C 31372041
0180 75672038
0184 34
0185 0D
0186 0A
0187 576F726B     268           DB      'Working with the UNID II iSBC 544 Internet
     Protocol (IP)',CR,LF
018B 696E6720
```

```
0100 3A0F04   C   190 PARE:   LDA     EVPAR   ;Get even par mask
LOC  OBJ          LINE        SOURCE STATEMENT

0103 B0           191 PARX:   ORA     B       ;Add in 7/8 and 1/2 bits
0104 47           192         MOV     B,A     ;Resave
                  193 ;
                  194 ;
                  195 ; User provided initialization routine (Baud rate, etc.)
                  196 ;****UART INITIALIZATION ROUTINE****
                  197 ;For WD or NS 8250 UART
                  198 ;
0105 3A1104   C   199         LDA     MCTLA   ;Get DTR, RTS, etc.
0108 D324         200         OUT     SMDMCT  ;Send it
010A 78           201         MOV     A,B     ;Get 7/8, 1/2, N/E/O bits
010B F680         202         ORI     80H     ;Set DLAB hi for data rate
010D D323         203         OUT     SLCTRL  ;Send it
010F 7E           204         MOV     A,M     ;Get 1st byte
0110 D320         205         OUT     SDATA   ;Send it
0112 23           206         INX     H
0113 7E           207         MOV     A,M     ;Get 2nd byte
0114 D321         208         OUT     SINTEN  ;Send it
0116 78           209         MOV     A,B     ;Reget 7/8, 1/2, N/E/O bits
0117 D323         210         OUT     SLCTRL  ;Send it
0119 AF           211         XRA     A       ;Init and clear last registers
011A D321         212         OUT     SINTEN
011C D325         213         OUT     SLSTAT
011E C9           214         RET
                  215 ;
                  216 ; Clear communications channel
                  217 ; Do not output anything to the remote!!!!!!
                  218 ;
011F DB20         219 CLRCM:  IN      SDATA
0121 C9           220         RET
                  221 ;
                  222 ; Check communications channel for anything
                  223 ; Return with accumulator=0 if nothing ready,
                  224 ; non-zero if a byte is waiting
                  225 ;
                  226 CMCHK:
0122 DB25         227         IN      SLSTAT
0124 E601         228         ANI     RXRDY
0126 C9           229         RET
                  230 ;
                  231 ; Input byte from remote terminal
                  232 ;
                  233 CMIN:
0127 DB25         234         IN      SLSTAT  ;Added for speed
0129 E601         235         ANI     RXRDY   ;added for speed
012B CA2701   C   236         JZ      CMIN    ;added for speed
012E DB20         237         IN      SDATA   ;Get good data
0130 C9           238         RET
```

```
0095 23            141          INX     H       ;Get selection
LOC  OBJ          LINE        SOURCE STATEMENT

0096 7E            142          MOV     A,M
0097 CD4501    C   143          CALL    VALNUM  ;Is it a valid number?
009A DA4600    C   144          JC      INITS   ;Repeat if not
009D 12            145          STAX    D       ;Save it
009E C34600    C   146          JMP     INITS   ;Another selection?
                   147 ;
00A1 3A4902    C   148 INIT1:   LDA     RATE    ;Get data rate
00A4 D630          149          SUI     '0'     ;Make binary
00A6 FE0A          150          CPI     10      ;Check for more than allowed
00A8 F24600    C   151          JP      INITS   ;Repeat if so
00AB 07            152          RLC             ;Double for two bytes/entry
00AC 21F603    C   153          LXI     H,BTBL  ;Get data rate table addr
00AF 1600          154          MVI     D,0     ;Init D
00B1 5F            155          MOV     E,A     ;Put offset in E
00B2 19            156          DAD     D       ;Add to table addr
                   157 ;
00B3 3A1703    C   158          LDA     BITS1   ;Get data bits
00B6 FE31          159          CPI     '1'     ;Check for 7 bit
00B8 CAC600    C   160          JZ      BITS7   ;It's 7 bit
00BB FE32          161          CPI     '2'     ;Check for 8 bit
00BD C24600    C   162          JNZ     INITS   ;Error,do again
00C0 3A0B04    C   163          LDA     BIT8    ;Get 8 bit mask
00C3 C3C900    C   164          JMP     BITSA   ;Continue
00C6 3A0A04    C   165 BITS7:   LDA     BIT7    ;Get 7 bit mask
00C9 47            166 BITSA:   MOV     B,A     ;Save it
                   167 ;
00CA 3A4803    C   168          LDA     BITS2   ;Get stop bits
00CD FE31          169          CPI     '1'     ;Check for 1 bit
00CF CAD900    C   170          JZ      STPA    ;It's 1 bit
00D2 FE32          171          CPI     '2'     ;Check for 2 bits
00D4 C24600    C   172          JNZ     INITS   ;Error, start over
00D7 3A0D04    C   173          LDA     STP2    ;Get 2 bit mask
00DA C3DC00    C   174          JMP     STPB    ;Continue
00DD 3A0C04    C   175 STPA:    LDA     STP1    ;Get 1 bit mask
00E0 B0            176 STPB:    ORA     B       ;Add 7/8 bit mask
00E1 47            177          MOV     B,A     ;Resave it
                   178 ;
00E2 3A7A03    C   179          LDA     PAR     ;Get parity
00E5 FE31          180          CPI     '1'     ;Check for none
00E7 CAF400    C   181          JZ      PARN    ;It's no parity
00EA FE32          182          CPI     '2'     ;Check for even
00EC CAD001    C   183          JZ      PARE    ;It's even parity
00EF FE33          184          CPI     '3'     ;Check for odd
00F1 C24600    C   185          JNZ     INITS   ;Error, go again
00F4 3A1004    C   186          LDA     ODPAR   ;Get odd par mask
00F7 C30301    C   187          JMP     PARX    ;Continue
00FA 3A0E04    C   188 PARN:    LDA     NOPAR   ;Get no par mask
00FD C30301    C   189          JMP     PARX    ;Continue
```

```
ISIS-II 8080/8085 MACRO ASSEMBLER, V4.1

                        92 ; Menu initialization routines
LOC  OBJ            LINE        SOURCE STATEMENT

                        93 ;
                        94 INIT:
0027 2A0100             95          lhld    wbvec + 1       ;Calculate the bios console
002A 110300             96          lxi     d,3             ; status, input, output vectors
002D 19                 97          dad     d
002E 222100         C   98          shld    const0
0031 19                 99          dad     d
0032 222300         C   100         shld    conin0
0035 19                 101         dad     d
0036 222500         C   102         shld    cnout0
                        103 ;
0039 114F01         C   104         LXI     D,MSGS  ;CCS signon
003C 0E09               105         MVI     C,9
003E CD0500             106         CALL    5
0041 0E01               107         MVI     C,1     ;Get keystroke
0043 CD0500             108         CALL    5
0046 111204         C   109 INITS:  LXI     D,CLEAR ;Clear screen
0049 0E09               110         MVI     C,9
004B CD0500             111         CALL    5
004E 110402         C   112         LXI     D,MENU
0051 0E09               113         MVI     C,9     ;Display menu selections
0053 CD0500             114         CALL    5
0056 111404         C   115         LXI     D,INBUF  ;Get selection
0059 0E0A               116         MVI     C,10
005B CD0500             117         CALL    5
005E 211504         C   118         LXI     H,INBUF+1  ;Check for null select
0061 7E                 119         MOV     A,M
0062 B7                 120         ORA     A
0063 CAA100         C   121         JZ      INIT1   ;No select, go initialize
0066 23                 122         INX     H       ;Get feature
0067 7E                 123         MOV     A,M
0068 CD3C01         C   124         CALL    ULCAS   ;Make upper case
006B FE41               125         CPI     'A'     ;Data rate?
006D 114902         C   126         LXI     D,RATE  ;Get save addr
0070 C27600         C   127         JNZ     INIT2   ;No
0073 C39400         C   128         JMP     SAVIT   ;Save it
0076 FE42               129 INIT2:  CPI     'B'     ;Data bits?
0078 111703         C   130         LXI     D,BITS1 ;Get save addr
007B C28100         C   131         JNZ     INIT3   ;No
007E C39400         C   132         JMP     SAVIT   ;Save it
0081 FE43               133 INIT3:  CPI     'C'     ;Stop bits?
0083 114803         C   134         LXI     D,BITS2 ;Get save addr
0086 C28C00         C   135         JNZ     INIT4   ;No
0089 C39400         C   136         JMP     SAVIT   ;Save it
008C FE44               137 INIT4:  CPI     'D'     ;Parity
008E 117A03         C   138         LXI     D,PAR   ;Get save addr
0091 C24600         C   139         JNZ     INITS   ;No
0094 23                 140 SAVIT:  INX     H       ;Go past delimiter
```

```
ISIS-II 8080/8085 MACRO ASSEMBLER, V4.1

0001                    43 DTRMSK  EQU     00000001B       ;DTR bit mask
LOC  OBJ              LINE        SOURCE STATEMENT

0002                    44 RTSMSK  EQU     00000010B       ;RTS bit mask
0010                    45 CTSMSK  EQU     00010000B       ;CTS bit mask
0020                    46 DSRMSK  EQU     00100000B       ;DSR bit mask
0040                    47 RIMSK   EQU     01000000B       ;RI bit mask
0080                    48 CXRMSK  EQU     10000000B       ;Received carrier detect
                        49 ;
000D                    50 CR      EQU     0DH
000A                    51 LF      EQU     0AH
0011                    52 XON     EQU     11H
0013                    53 XOF     EQU     13H
0005                    54 bdos0   equ     5
0000                    55 wbvec   equ     0
                        56 ;
                        57         cseg            ;Relative assembly for ASM80
                        58 ;
                        59 ; Start of jump table is public
                        60 ;
                        61         public  sinit, sclrcm, scmchk, scmin, scmout
                        62 ;
                        63 ; Console, BDOS, and warm boot are public
                        64 ;
                        65         public  const, conin, conout, bdos, exit
                        66 ;
                        67 ; Jump table
                        68 ;
                        69 START:
0000 C32700     C       70 sinit:  JMP     INIT    ;Initialization
0003 C31F01     C       71 sclrcm: JMP     CLRCM   ;Clear comm channel
0006 C32201     C       72 scmchk: JMP     CMCHK   ;Check channel
0009 C32701     C       73 scmin:  JMP     CMIN    ;Input byte
000C C33101     C       74 scmout: JMP     CMOUT   ;Output byte
                        75 ;
                        76 ; CP/M BDOS and BIOS call vectored jumps
                        77 ;
000F C30500             78 bdos:   jmp     bdos0   ;Bdos call
0012 C30000             79 exit:   jmp     wbvec   ;Warm boot
                        80 ;
0015 2A2100     C       81 const:  lhld    const0  ;Bios console status
0018 E9                 82         pchl
0019 2A2300     C       83 conin:  lhld    conin0  ;Bios console input
001C E9                 84         pchl
001D 2A2500     C       85 conout: lhld    cnout0 ;Bios console output
0020 E9                 86         pchl
0021 0000               87 const0: dw      0       ;Bios console status vector
0023 0000               88 conin0: dw      0       ;Bios console input vector
0025 0000               89 cnout0: dw      0       ;Bios console output vector
                        90 ;
                        91 ;
```

```
ISIS-II 8080/8085 MACRO ASSEMBLER, V4.1

 LOC  OBJ          LINE        SOURCE STATEMENT

                      1 ;***********************************************
                      2 ;            LINK80 SUBROUTINES                *
                      3 ;***********************************************
                      4 ;
                      5 ; In directory as TSBS.ASM, SBS.ASM, or SBS.MOD
                      6 ; Set up for California Computer System 2810 CPU
                      7 ;    (at 4 MHz) which uses the WD or NS 8250 UART
                      8 ; This software module was developed by Capt C. T.(Tom)
                      9 ;    Childress on his own time and with his own resources
                     10 ;    for use with his own CP/M system communications
                     11 ;    program.  It is a proven module of software.  This
                     12 ;    software and his system are used in his thesis as a
                     13 ;    software validation tool for the SBC 544 board.
                     14 ;    Any other use without prior written permission from
                     15 ;    Capt Childress is strictly prohibited.
                     16 ;
                     17 ;Vers 1.0, 10 May 82
                     18 ;Vers 1.1, 26 Sep 82
                     19 ;Vers 1.2, 19 Oct 82
                     20 ;Vers 1.3, 11 Feb 83, New video board driver, 19.2 & 38.4 kbps
                     21 ;Vers 1.4, 24 Mar 83, Changed to 4MHz, ABCD drives
                     22 ;Vers 1.5,  3 Jul 83, Added XON/XOFF toggle for Terminal transmit
file mode
                     23 ;                     Added Echo to remote for terminal mode
                     24 ;Vers 1.6, 30 Jul 84, Deleted the XON/OFF and Echo for use with
higher speeds
                     25 ;                     in the terminal mode file transfer mode
                     26 ;Vers 1.7, 17 Aug 84, Modified to work with the UNID II ISBC 544
to support
                     27 ;                     the Internet Protocol (IP) datagram exchange
running
                     28 ;                     on the iSBC 544.
                     29 ;
                     30 ; EQUATES
                     31 ;
  0020               32 SDATA   EQU     20H     ;Serial data port
  0021               33 SINTEN  EQU     SDATA+1 ;Interrupt enable port
  0022               34 SIDENT  EQU     SDATA+2 ;Interrupt identification port
  0023               35 SLCTRL  EQU     SDATA+3 ;Line control (+DLAB) port
  0024               36 SMDMCT  EQU     SDATA+4 ;Modem control port
  0025               37 SLSTAT  EQU     SDATA+5 ;Line status port
  0026               38 SMDMST  EQU     SDATA+6 ;Modem status port
                     39 ;
  0001               40 RXRDY   EQU     00000001B       ;Rx data available
  0020               41 TXMTY   EQU     00100000B       ;Tx buffer empty
  000E               42 ERROR   EQU     00001110B       ;Error bit mask
```

4b. Assembly Language Module

The purpose of this module is to provide the main PL/M80 program with the communications to the UNID II and provide the console I/O interface with the CP/M BDOS. The module is written in Intel assembly languange. It is independently written outside this thesis effort and was used here because it provides the known working high data rate (9600 bps) communications needed for the interaction with the UNID II.

```
 ISIS-II PL/M-80 V3.0 COMPILATION OF MODULE MONITOR
NO OBJECT MODULE REQUESTED
COMPILER INVOKED BY:  PLM80 :F1:MON544.SRC NOOBJECT

            $TITLE('ISBC 544 MONITOR TEST, 1900 HRS 17 JULY 1984')
            $NOINTVECTOR

             /*************************************************************/
             /*                                                           */
             /*  DATE:          17 July 1984                              */
             /*  VERSION:       1.0                                       */
             /*                                                           */
             /*  TITLE:         SBC 544 Monitor                           */
             /*  FILE NAME:     SBC544.SRC                                */
             /*  OWNER:         C. T. Childress                           */
             /*                                                           */
             /*  SOFTWARE SYSTEM: Intel System III, ISIS II (V 4.2, 4.3)  */
             /*  USE:           Provide a bare minimum monitor capability  */
             /*                 for the SBC 544 board                     */
             /*                                                           */
             /*  CONTENTS:      Source Code Listing                       */
             /*                                                           */
             /*************************************************************/

            /*************************************************************************

            ABSTRACT

            THIS PROGRAM IS THE ROM BASED MONITOR FOR THE iSBC 544. IT PROVIDES
            THE USER WITH A MODERATE LEVEL OF CAPABILITY TO EXAMINE/MODIFY MEMORY
            AND REGISTERS, CONTROL PROGRAM EXECUTION, AND LOAD PROGRAMS.

            ENVIRONMENT

            THE SBC MONITOR COMMUNICATES WITH THE USER VIA AN INTERACTIVE TERMINAL
            (TTY,CRT) ATTACHED TO SERIAL PORT 0.

            PROGRAM ORGANIZATION

            THE PROGRAM IS DIVIDED INTO 1 DATA AND 2 CODE MODULES:
              1. DATA DECLARATION MODULE.  GLOBAL DATA DECLARATIONS.
              2. COMMON ROUTINES.          LOWER LEVEL PROCEDURES
              3. COMMAND MODULE.           INDIVIDUAL COMMANDS AND OUTER BLOCK


            CALLING GRAPH

              >>COMMAND DISPATCH MODULE (OUTER BLOCK)
                   INDIVIDUAL COMMAND PROCCEDURES
                        COMMON ROUTINES
```

```
                GLOBAL DATA STRUCTURES

                THE MONITOR MAINTAINS THE USER'S MACHINE STATE (REGISTERS) IN A
                WORD ARRAY. THE REGISTERS ARE SAVED FROM THE USER'S STACK
                AS PUSHED BY PLM86 INTERRUPT PROCEDURE.

                ADDRESSES TO THE 2**16 ADDRESS SPACE ARE IMPLEMENTED WITH
                ADDRESS STRUCTTURES ALLOCATED AS TWO ADDRESS STRUCTURES.*/

  1             MONITOR:DO;     /*BEGINNING OF MODULE*/

                /*****************************************************************

                GLOBAL DATA DECLARATIONS MODULE

                ABSTRACT

                THIS MODULE CONTAINS ALL THE GLOBAL DATA DECLARATIONS AND
                LITERALS (EQUATES).

                MODULE ORGANIZATION

                THE MODULE IS DIVIDED INTO 5 SECTIONS:
                  1. UTILITY SECTION      GLOBAL FLAGS,VARIABLES,EQUATES
                  2. I/O SECTION          I/O PORTS,MASKS,AND SPECIAL CHARS
                  3. MEMORY ARGUMENTS SECTIONS      STRUCTURES FOR ADDRESSS
                  4. REGISTER SECTION     USER REGISTER SAVE AREA
                */

                /*******************
                * UTILITY SECTION  *
                *******************/

  2   1         R$MASK: PROCEDURE BYTE EXTERNAL;    /* USE THE PLM80.LIB WHEN LINKING */
  3   2                 END R$MASK;

  4   1         S$MASK: PROCEDURE (MASK) EXTERNAL;
  5   2             DECLARE MASK BYTE;
  6   2             END S$MASK;

  7   1         DECLARE
                    INT$VECTOR(8)   ADDRESS,    /* INTERRUPT VECTORS */
                    TRAP$INT        ADDRESS,    /* POWER FAIL SENSE */
                    INT$75          ADDRESS,    /* TIMER INPUTS, TINTO & TINT1 */
                    INT$65          ADDRESS,    /* RING INDICATOR AND CARRIER DETECT */
                    INT$55          ADDRESS,    /* FLAG (FINT) AND MULTIBUS INTERRUPT */
                    RIM$MASK        BYTE,       /* INTERRUPT MASK RETURNED BY RIM */
                    TRAP$INT$PTR    LITERALLY   '024H',     /* INTERRUPT LOCATIONS */
                    INT$75$PTR      LITERALLY   '03CH',
                    INT$65$PTR      LITERALLY   '034H',
```

```
                INT$55$PTR      LITERALLY   '02CH';

 8   1      DECLARE
                MONITOR$STACKPTR  ADDRESS;

 9   1      DECLARE
                SIGNON$MSG(*) BYTE DATA (0DH,0AH,
                '                       ISBC 544 MONITOR, V1.0',0DH,0AH,0AH,
                '          for the Universal Network Interface Device (UNID) II',
                                  0DH,0AH,0AH,
                '                            17 July 1984',0DH,0AH,0AH,0AH,0);

10   1      DECLARE
                START$MSG(*) BYTE DATA ('Start addr = ', 0DH,0AH,0),
                CHECK$SUM$ERR$MSG(*) BYTE DATA ('Check sum error', 0DH,0AH,0),
                MEM$RW$ERR(*) BYTE DATA ('Memory R/W error', 0DH,0AH,0);

11   1      DECLARE
                CHAR        BYTE,       /*ONE CHAR LOOK AHEAD*/
                CHECK$SUM   BYTE,       /*PAPER TAPE CHECKSUM*/
                I       BYTE,           /*INDEX*/
                J       BYTE,           /*INDEX*/
                II      ADDRESS,        /*INDEX*/
                JJ      ADDRESS,        /*INDEX*/
                END$OFF     ADDRESS,    /*END OFFSET ADDRESS*/
                WORD$MODE   BYTE,       /*ADDRESS MODE FLAG*/
                LAST$COMMAND    BYTE,   /*LAST COMMAND SAVE*/
                MODE        BYTE,       /*R MODE*/
                SAVE$MODE   BYTE,       /*SAVE MODE*/
                BRF     ADDRESS;        /*BAUD RATE FACTOR*/

12   1      DECLARE
                TRUE        LITERALLY '0FFH',
                FALSE       LITERALLY '000H',
                MAX$DELAY   LITERALLY '60000',  /*DELAY FOR READ CHAR*/
                TAPE        LITERALLY '1H',     /*TAPE MODE*/
                SERIAL      LITERALLY '2H',     /*SERIAL MODE*/
                PARALLEL    LITERALLY '4H',     /*PARALLEL MODE*/
                ASCR        LITERALLY '0DH',    /*CARRIAGE RETURN*/
                ASLF        LITERALLY '0AH',    /*LINE FEED*/
                ASBL        LITERALLY '20H';    /*BLANK OR SPACE*/

13   1      DECLARE
                ASCII(*)      BYTE DATA ('0123456789ABCDEF'),
                SIO$CMND(*)   BYTE DATA ('SGMDCFHRZ');

                /**********************************
                * I/O DECLARATIONS SECTION        *
                **********************************/

14   1      DECLARE                      /* 8251 USARTS */
```

```
                SIO$P0$CMD      LITERALLY '0D1H',   /* SERIAL PORT 0 COMMAND */
                SIO$P0$STAT     LITERALLY '0D1H',   /* SERIAL PORT 0 STATUS */
                SIO$P0$DATA     LITERALLY '0D0H',   /* SERIAL PORT 0 DATA */
                SIO$P1$CMD      LITERALLY '0D3H',   /* SERIAL PORT 1 COMMAND */
                SIO$P1$STAT     LITERALLY '0D3H',   /* SERIAL PORT 1 STATUS */
                SIO$P1$DATA     LITERALLY '0D2H',   /* SERIAL PORT 1 DATA */
                SIO$P2$CMD      LITERALLY '0D5H',   /* SERIAL PORT 2 COMMAND */
                SIO$P2$STAT     LITERALLY '0D5H',   /* SERIAL PORT 2 STATUS */
                SIO$P2$DATA     LITERALLY '0D4H',   /* SERIAL PORT 2 DATA */
                SIO$P3$CMD      LITERALLY '0D7H',   /* SERIAL PORT 3 COMMAND */
                SIO$P3$STAT     LITERALLY '0D7H',   /* SERIAL PORT 3 STATUS */
                SIO$P3$DATA     LITERALLY '0D6H',   /* SERIAL PORT 3 DATA */
                SIO$MODE        LITERALLY '04EH',   /* SERIAL PORT MODE */
                SIO$COMMAND     LITERALLY '027H',   /* SERIAL PORT COMMAND */

                SIO$RESET$CMD   LITERALLY '40H',    /* RESET USART */
                SIO$CRT$MODE    LITERALLY '4EH',    /* CRT MODE */
                SIO$TTY$MODE    LITERALLY '0CFH',   /* TTY MODE */
                SIO$DTR$ON      LITERALLY '27H',    /* RTS,RXE,DTR,TXE */
                SIO$CRT$CMD     LITERALLY '37H',    /* RTS,ER,RXE,DTR,TXE */
                SIO$TTY$CMD     LITERALLY '35H',    /* RTS,ER,RXE,TXE */
                SIO$DTR$OFF     LITERALLY '25H',    /* RTS,RXE,TXE */
                SIO$RXRDY       LITERALLY '02H',    /* RECIEVER READY */
                SIO$TXE         LITERALLY '04H',    /* TRANSMITTER EMPTY */
                SIO$TXRDY       LITERALLY '01H',    /* TRANSMITTER READY */
                PARITY$MASK     LITERALLY '7FH';    /* MASK OFF PARITY BIT */

15  1       DECLARE                     /* 8253 INTERVAL TIMER */
                IT1$CONT    LITERALLY '0D6H',   /* INTERVAL TIMER 1 CONTROL */
                IT1$CNTR0   LITERALLY '0D8H',   /* COUNTER 0, USART 0 */
                IT1$CNTR1   LITERALLY '0D9H',   /* COUNTER 1, USART 1 */
                IT1$CNTR2   LITERALLY '0DAH',   /* COUNTER 2, USART 2 */
                IT2$CONT    LITERALLY '0DFH',   /* INTERVAL TIMER 2 CONTROL */
                IT2$CNTR0   LITERALLY '0DCH',   /* COUNTER 3, USART 3 */
                IT2$CNTR1   LITERALLY '0DDH',   /* COUNTER 4, CNTR5 OR SPLIT CLOCKS */
                IT2$CNTR2   LITERALLY '0DEH',   /* COUNTER 5, RST 7.5 */
                USART$CNTR$M3 LITERALLY '036H',/* DIVIDE BY N RATE GENERATOR, MODE 3,*/
                                    /* FOR USART CLK x 16, CLK = 1.2288 MHZ */

                B19200      LITERALLY '4',      /* TIMER VALUE FOR 19.2 KBPS */
                B9600       LITERALLY '8',      /* TIMER VALUE FOR 9600 BPS */
                B4800       LITERALLY '16',     /* TIMER VALUE FOR 4800 BPS */
                B2400       LITERALLY '32',     /* TIMER VALUE FOR 2400 BPS */
                B1200       LITERALLY '64',     /* TIMER VALUE FOR 1200 BPS */
                B600        LITERALLY '128',    /* TIMER VALUE FOR 600 BPS */
                B300        LITERALLY '256',    /* TIMER VALUE FOR 300 BPS */
                B150        LITERALLY '512',    /* TIMER VALUE FOR 150 BPS */
                B110        LITERALLY '698';    /* TIMER VALUE FOR 110 BPS */

15  1       DECLARE                     /*8155 PERIPHERAL INTERFACE*/
                PI$PORTA    LITERALLY '0E9H',   /* PORT A (OUTPUT) */
```

```
        PI$PORTB    LITERALLY '0EAH',   /* PORT B (INPUT) */
        PI$PORTC    LITERALLY '0EBH',   /* PORT C (INPUT) */
        PI$STAT     LITERALLY '0E8H',   /* PPI STATUS */
        PI$CMD      LITERALLY '0E8H',   /* PPI COMMAND */
        PI$CNTR$LO  LITERALLY '0ECH',   /* PPI COUNTER LO BYTE */
        PI$CNTR$HI  LITERALLY '0EDH',   /* PPI COUNTER HI BYTE */
        PI$CNTR$LOCNT LITERALLY '16384', /* PPI COUNTER TIME CONST */
        PI$CNTR$HICNT LITERALLY '75',   /* PPI COUNTER TIME CONST */
        PI$INIT$CMD1  LITERALLY '041H', /* PPI INITIALIZATION COMMAND 1 */
                                        /* A OUT, B & C IN, STOP COUNT */
        PI$INIT$CMD2  LITERALLY '0C1H', /* PPI INITIALIZATION COMMAND 2 */
                                        /* A OUT, B & C IN, START COUNT */
        PI$INIT$SIO$INT1 LITERALLY '0F0H', /* USART AND INT CONT RESET */
        PI$INIT$SIO$INT2 LITERALLY '0C0H', /* USART AND INT CONT NORMAL */

        PI$PORTC$STAT   LITERALLY '0CCH',   /*PORT C STATUS*/
        PI$PORTC$CTL    LITERALLY '0CEH',   /*PORT C CONTROL*/
        PI$M2M1     LITERALLY '0C6H',   /*A-MODE 1, B-MODE 2*/
        PI$OBF      LITERALLY '080H',   /*OUTPUT BUFFER READY*/
        PI$IBF      LITERALLY '02H';    /*INPUT BUFFER READY'*/


17  1   DECLARE                     /*8259 INTERRUPT CONTROLLER*/
        IC$PORTA    LITERALLY '0E6H',   /* PORT A */
        IC$PORTB    LITERALLY '0E7H',   /* PORT B */
        IC$ICW1     LITERALLY '17H',    /* INIT COMMAND ADDRESS 1 */
        IC$ICW2     LITERALLY '00H',    /* INIT COMMAND ADDRESS 2 */
        IC$ICW3     LITERALLY '00H',    /* INIT COMMAND ADDRESS 3 */
        IC$ICW4     LITERALLY '1DH',    /* INIT COMMAND ADDRESS 4 */
        IC$MASK     LITERALLY '0FFH',   /* INTERRUPT MASK, OCW1 */
        IC$EOI      LITERALLY '20H',    /* END OF INTERRUPT CMD, OCW2 */
        IC$OCW3     LITERALLY '08H';    /* READ INTERRUPT LEVEL, OCW3 */

    /*******************************
    *  REGISTER ASSIGNMENTS        *
    *******************************/

18  1   DECLARE
        CS  ADDRESS,
        IP  ADDRESS;

    /*****************************
    *  MEMORY ARGUMENT SECTION  *
    *****************************/

19  1   DECLARE
        MEMORY$ARG1$PTR  ADDRESS,       /*ARGUMENT 1*/
        ARG1 STRUCTURE (OFF ADDRESS, SEG ADDRESS)
            AT (.MEMORY$ARG1$PTR),
        MEMORY$ARG1 BASED MEMORY$ARG1$PTR BYTE,
        MEMORY$ADDRESS$ARG1 BASED MEMORY$ARG1$PTR ADDRESS,
```

```
    MEMORY$ARG2$PTR ADDRESS,        /*ARGUMENT 2*/
    ARG2 STRUCTURE (OFF ADDRESS, SEG ADDRESS)
        AT (.MEMORY$ARG2$PTR),
    MEMORY$ARG2 BASED MEMORY$ARG2$PTR BYTE,

    MEMORY$ARG3$PTR ADDRESS,            /*ARGUMENT3*/
    ARG3 STRUCTURE (OFF ADDRESS, SEG ADDRESS)
        AT (.MEMORY$ARG3$PTR),
    MEMORY$ARG3 BASED MEMORY$ARG3$PTR BYTE,

    MEMORY$CSIP$PTR ADDRESS,        /*CS & IP ADDRESS*/
    CSIP STRUCTURE (OFF ADDRESS, SEG ADDRESS)
        AT (.MEMORY$CSIP$PTR),
    MEMORY$CSIP BASED MEMORY$CSIP$PTR BYTE,

    MEMORY$USERSTACK$PTR ADDRESS,
    USERSTACK STRUCTURE (OFF ADDRESS, SEG ADDRESS)
        AT (.MEMORY$USERSTACK$PTR),
    MEMORY$USERSTACK BASED MEMORY$USERSTACK$PTR ADDRESS;

/*****************************
* REGISTER SECTION           *
*****************************/

/*****************************************************************************

            COMMON PROCEDURES

ABSTRACT

THIS MODULE CONTAINS THOSE LOWER LEVEL PROCEDURES CALLED BY HIGHER
LEVEL ROUTINES.

MODULE ORGANIZATION

THIS MODULE IS DIVIDED INTO 4 SECTIONS AS FOLLOWS:
    1.BASIC I/O SECTION
        SIO$CHAR$RDY          INPUT CHARACTER READY
        SIO$CHECK$CONTROL$CHAR  CHECK FOR CONTROL CHARACTER
        SIO$OUT$CHAR          OUTPUT CHARACTER
        SIO$GET$CHAR          INPUT A CHARACTER
        SIO$OUT$BYTE          OUTPUT A BYTE IN HEX
        SIO$OUT$BYTE$ADDRESS    OUTPUT BYTE AT ADDRESS
        SIO$OUT$WORD          OUTPUT A ADDRESS IN HEX
        SIO$OUT$BLANK         OUTPUT A SINGLE BLANK
        SIO$OUT$STRING        OUTPUT A STRING
    2.UTILITY ROUTINES SECTION
        SIO$VALID$HEX         TEST FOR VALID HEX CHAR
        SIO$HEX           CONVERT TO HEX FROM ASCII
        SIO$VALID$REG$FIRST TEST FOR VALID REGISTER FIRST CHAR
```

```
                    SIO$VALID$REG       TEST FOR VALID REGISTER NAME
                    SIO$CRLF        OUTPUTS A CR AND LF
                    SIO$TEST$WORD$MODE  TEST FOR A 'W' IN COMMAND
                    SIO$SCAN$BLANK      SCANS FOR OPTIONAL BLANK
                    SIO$SECOND$DELAY    DELAY ONE SECOND
                    SIO$MS$DELAY        DELAY N MS
                3.ARGUMENT EXPRESSION EVALUATION SECTION
                    SIO$GET$WORD        GET A WORD EXPRESSION
                    SIO$GET$ADDR        GET AN ADDRESS EXPRESSION
                    SIO$UPDATE$IP       OPTIONAL UPDATE OF CS:IP
                4.DEVICE INITIALIZATION SECTION
                    SIO$RESET$CMD$USART     RESET 8251A
                    SIO$INIT$MODE       INITIALIZE FOR LOAD/TRANSFER
                5.PAPER TAPE, SERIAL,PARALLEL READ SECTION
                    SIO$READ$CHAR       READ CHAR FROM TTY READER
                    SIO$READ BYTE       READ A BYTE
                    SIO$READ$WORD       READ AN ADDRESS
                    SIO$READ$HEX$FILE   INPUT HEX FILE
                6.INTERRUPT AND RESTORE/EXECUTE ROUTINES
                    SAVE$REGISTERS      SAVES USER REGISTERS
                    RESTORE$EXECUTE     RESTORE MACHINE STATE AND EXEC
                    INTERRUPT1$ENTRY    INTERRUPT ROUTINE FOR SINGLE STEP
                    INTERRUPT3$ENTRY    INTERRUPT ROUTINE FOR GO
                    INTERRUPT32$ENTRY   INTERRUPT ROUTINE FOR 8259A
                    INIT$INT$VECTOR     INITIALIZES INTERRUPT VECTORS
            */
            /**********************
            * BASIC I/O SECTION   *
            **********************/

20  1       SIO$CHAR$RDY:
                /*TESTS FOR INPUT CHARACTER PENDING BY READING THE STATUS PORT
                AND MASKING WITH SIO$RXRDY(READ DATA READY.) RETURNS TRUE IF
                NOT EMPTY(CHAR PENDING) AND FALSE IF NO CHAR PENDING*/

                PROCEDURE BYTE;
21  2               IF (INPUT(SIO$PO$STAT) AND SIO$RXRDY) = 0 THEN RETURN FALSE;
23  2               RETURN TRUE;
24  2       END SIO$CHAR$RDY;

25  1       SIO$CHECK$CONTROL$CHAR:
                /*THIS ROUTINE CHECKS IF A CONTROL CHARACTER HAS BEEN INPUT TO
                THE SERIAL I/O PORT. AFTER A CONTROL-S IT WAITS FOR A CONTROL-Q
                BEFORE RETURNING TO THE CALLER. A CONTROL-C CAUSES A JUMP TO THE
                ERROR ROUTINE*/

                PROCEDURE;
25  2               CHAR = INPUT(SIO$PO$DATA) AND 07FH;
27  2               IF CHAR = 13H THEN          /*CONTROL-S*/
28  2                   DO WHILE CHAR <> 11H;       /*CONTROL-Q?*/
29  3                       IF SIO$CHAR$RDY THEN
```

```
 30   3                        DO;
 31   4                        CHAR = INPUT(SIO$PO$DATA) AND 07FH;
 32   4                        IF CHAR = 03H THEN GOTO ERROR;
 34   4                        END;
 35   3                    END;
 36   2               ELSE IF CHAR = 03H THEN GOTO ERROR;
                  END SIO$CHECK$CONTROL$CHAR;

 39   1       SIO$OUT$CHAR:
                  /*THIS ROUTINE OUTPUTS THE INPUT PARAMETER TO THE USART
                  OUTPUT PORT WHEN USART IS READY FOR OUTPUT (XMIT BUFFER
                  EMPTY).*/

                  PROCEDURE(C);
 40   2               DECLARE C BYTE;
 41   2       LOOP:   IF SIO$CHAR$RDY THEN CALL SIO$CHECK$CONTROL$CHAR;
 43   2               IF (INPUT(SIO$PO$STAT) AND SIO$TXRDY) = 0 THEN GOTO LOOP;
 45   2               OUTPUT(SIO$PO$DATA) = C;
 46   2       END SIO$OUT$CHAR;

 47   1       SIO$GET$CHAR:
                  /*THIS ROUTINE INPUTS A CHARACTER FROM THE INPUT PORT AND RETURNS
                  WITH IT IN THE GLOBAL 'CHAR'. THE CHARACTER IS ECHOED TO THE
                  OUTPUT PORT IF PRINTABLE.*/
                  PROCEDURE;
 48   2                DO WHILE (INPUT(SIO$PO$STAT) AND SIO$RXRDY) = 0; END;
 50   2                CHAR = INPUT(SIO$PO$DATA) AND 07FH;
 51   2                IF CHAR>=ASBL THEN CALL SIO$OUT$CHAR(CHAR);
 53   2       END SIO$GET$CHAR;

 54   1       SIO$OUT$BYTE:
                  /*THIS ROUTINE OUTPUTS THE SINGLE INPUT PARAMETER TO THE USART
                  IN ASCII HEXADECIMAL  FORMAT.*/
                  PROCEDURE(B);
 55   2                DECLARE B BYTE;
 56   2                CALL SIO$OUT$CHAR(ASCII(SHR(B,4) AND 0FH));
 57   2                CALL SIO$OUT$CHAR(ASCII(B AND 0FH));
 58   2       END SIO$OUT$BYTE;

 59   1       SIO$OUT$BYTE$PTR:
                  /*THIS ROUTINE OUTPUTS THE BYTE BASED ON THE INPUT PARAMETER TO THE
                  USART IN ASCII HEXADECIMAL FORMAT. */
                  PROCEDURE (B$PTR);
 60   2                DECLARE B$PTR ADDRESS, B BASED B$PTR BYTE, X BYTE;
 61   2                X = B;
 62   2                CALL SIO$OUT$BYTE(X);
 63   2       END SIO$OUT$BYTE$PTR;

 64   1       SIO$OUT$WORD:
                  /* THIS ROUTINE OUTPUTS THE INPUT PARAMETER AS 4 ASCII HEXADECIMAL
                  CHARACTERS TO THE USART OUTPUT PORT.*/
```

```
                    PROCEDURE(W);
 65   2                 DECLARE W ADDRESS;
 66   2                 CALL SIO$OUT$BYTE(HIGH(W));
 67   2                 CALL SIO$OUT$BYTE(LOW(W));
 68   2           END SIO$OUT$WORD;

 69   1           SIO$OUT$BLANK:
                    /*THIS ROUTINE OUTPUTS ONE BLANK. */
                    PROCEDURE;
 70   2                 CALL SIO$OUT$CHAR(ASBL);
 71   2           END SIO$OUT$BLANK;

 72   1           SIO$OUT$STRING:
                    /* OUTPUTS A STRING POINTED TO BY THE FIRST PARM. */
                    PROCEDURE(PTR);
 73   2                 DECLARE PTR ADDRESS, STR BASED PTR (1) BYTE;
 74   2                 I = 0;
 75   2                 DO WHILE STR(I)<>0;
 76   3                     CALL SIO$OUT$CHAR(STR(I));
 77   3                     I = I + 1;
 78   3                 END;
 79   2           END SIO$OUT$STRING;

                    /**************************
                    * UTILITY ROUTINES SECTION*
                    **************************/

 80   1           SIO$VALID$HEX:
                    /*THIS ROUTINE TESTS IF THE INPUT PARAM IS A VALID ASCII HEX DIGIT
                    AND RETURNS TRUE AS THE VALUE OF THE PROCEDURE IF SO AND FALSE
                    IF NOT.*/
                    PROCEDURE (H) BYTE;
 81   2                 DECLARE H BYTE;
 82   2                 DO I = 0 TO LAST(ASCII);
 83   3                     IF H=ASCII(I) THEN RETURN TRUE;
 85   3                 END;
 86   2                 RETURN FALSE;
 87   2           END SIO$VALID$HEX;

 88   1           SIO$HEX:
                    /*THIS ROUTINE CONVERTS THE INPUT PARM FROM ASCII TO ITS BINARY
                    EQUIVALENT AND RETURNS IT AS THE VALUE OF THE PROCEDURE. NO CHECK
                    IS MADE FOR INPUT VALIDITY.*/
                    PROCEDURE(C) ADDRESS;
 89   2                 DECLARE C BYTE;
 90   2                 IF C<='9' THEN RETURN DOUBLE(C-30H);
 92   2                 ELSE RETURN DOUBLE(C-37H);
 93   2           END SIO$HEX;

 94   1           SIO$CRLF:
                    /* THIS ROUTINE OUTPUTS A CR AND LF TO THE OUTPUT PORT.*/
```

```
                    PROCEDURE;
 95   2                 CALL SIO$OUT$CHAR(ASCR);
 96   2                 CALL SIO$OUT$CHAR$(ASLF);
 97   2           END SIO$CRLF;

 98   1           SIO$TEST$WORD$MODE:
                    /* THIS PROCEDURE TESTS FOR A 'W' FOLLOWING THE COMMAND AND IF SO
                    SETS THE FLAG 'WORD$MODE TO TRUE OR FALSE OTHERWISE. SCANS OFF
                    OPTIONAL BLANK FOLLOWING COMMAND. */
                    PROCEDURE;
 99   2                 WORD$MODE = FALSE;
100   2                 CALL SIO$GET$CHAR;
101   2                 IF CHAR = 'W' THEN
```

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```
102   2                 DO;
103   3                 WORD$MODE = TRUE;
104   3                 CALL SIO$GET$CHAR;
105   3                 END;
106   2               IF CHAR = ASBL THEN
107   2                   CALL SIO$GET$CHAR;
108   2       END SIO$TEST$WORD$MODE;

109   1       SIO$SCAN$BLANK:
                  /*THIS ROUTINE IS CALLED AFTER A COMMAND LETTER TO SCAN OFF THE
                  OPTIONAL BLANK.*/
                  PROCEDURE;
110   2               CALL SIO$GET$CHAR;
111   2               IF CHAR = ASBL THEN
112   2                   CALL SIO$GET$CHAR;
113   2       END SIO$SCAN$BLANK;

114   1       SIO$SECOND$DELAY:
                  /*THIS ROUTINE CAUSES A DELAY OF APPROXIMATELY 1 SECOND.*/
                  PROCEDURE;
115   2               DECLARE II ADDRESS;
116   2               DO II = 1 TO 0F000H; END;
118   2       END SIO$SECOND$DELAY;

119   1       SIO$MS$DELAY:
                  /*THIS ROUTINE CAUSES A DELAY OF 1 OR MORE MILLISECONDS; THE NUMBER
                  IS PASSED BY THE CALLER. THE DELAY IS APPROXIMATE.*/
                  PROCEDURE (N);
120   2               DECLARE (N,I,J) BYTE;
121   2               DO I = 1 TO N;
122   3                   DO J = 1 TO 55; END;
124   3               END;
125   2       END SIO$MS$DELAY;


                  /*****************************************
                  * ARGUMENT EXPRESSION EVALUATION SECTION   *
                  *****************************************/

126   1       SIO$GET$WORD:
                  /*THIS ROUTINE READS CHARS FROM THE INPUT PORT AND EVALUATES
                  AN EXPRESSION CONSISTING OF '+-' AND OPERANDS OF HEX NUMBERS
                  AND REGISTER NAMES.*/
                  PROCEDURE ADDRESS;
127   2               DECLARE (SAVE,W) ADDRESS, (OPER,T) BYTE;
128   2               OPER = '+';
129   2               W = 0;
130   2               DO WHILE TRUE;
```

```
131   3                 T = CHAR;
132   3                 SAVE = 0;
133   3                 IF NOT(SIO$VALID$HEX(T)) THEN GOTO ERROR;
135   3                 DO WHILE SIO$VALID$HEX(CHAR);
136   4                     SAVE = SHL(SAVE,4) + SIO$HEX(CHAR);
137   4                     CALL SIO$GET$CHAR;
138   4                 END;
139   3     EVAL:           IF OPER = '+' THEN
140   3                     W = W + SAVE;
                        ELSE
141   3                     W = W - SAVE;
142   3                 IF CHAR = ASCR OR CHAR = ':' OR CHAR = ',' THEN
143   3                     RETURN W;
144   3                 IF CHAR = '+' OR CHAR = '-' THEN
145   3                     OPER = CHAR;
                        ELSE
146   3                     GOTO ERROR;
147   3                 CALL SIO$GET$CHAR;
148   3             END;
149   2     END SIO$GET$WORD;

150   1     SIO$GET$ADDR:
            /* THIS ROUTINE ACCEPTS A VALID ADDRESS EXPRESSION CONSISTING
            OF AN OPTIONAL <SEG>: AND AN DISPLACEMENT. */
            PROCEDURE(PTR,DEFAULT$BASE);
151   2         DECLARE PTR ADDRESS, DEFAULT$BASE ADDRESS,
                    ARG BASED PTR STRUCTURE (OFF ADDRESS, SEG ADDRESS);
152   2         ARG.SEG = DEFAULT$BASE;
153   2         ARG.OFF = SIO$GET$WORD;
154   2         IF CHAR =':' THEN
155   2             DO;
156   3             CALL SIO$GET$CHAR;
157   3             ARG.SEG = ARG.OFF;
158   3             ARG.OFF = SIO$GET$WORD;
159   3             IF CHAR = ':' THEN GOTO ERROR;
161   3             END;
162   2     END SIO$GET$ADDR;

163   1     SIO$GET$BYTE:
            /* THIS PROCEDURE IS CALLED TO INPUT HEX CHARACTERS FROM THE
            INPUT USART AND RETURN WITH THE BINARY VALUE          */
            PROCEDURE BYTE;
164   2         DECLARE SAVE BYTE;

165   2         SAVE = 0;
166   2         CALL SIO$GET$CHAR;
167   2         IF NOT (SIO$VALID$HEX(CHAR)) THEN GOTO ERROR;
169   2         DO WHILE SIO$VALID$HEX(CHAR);
170   3             SAVE = SHL(SAVE,4) + SIO$HEX(CHAR);
171   3             CALL SIO$GET$CHAR;
172   3         END;
```

```
173   2          RETURN SAVE;
174   2      END SIO$GET$BYTE;

175   1      SIO$UPDATE$IP:
                 /*THIS PROCEDURE IS CALLED BY 'GO' TO OUTPUT THE
                 CURRENT IP AND INSTRUCTION BYTE AND OPEN THE IP FOR INPUT.*/
                 PROCEDURE;
176   2              CALL SIO$OUT$BLANK;
177   2              CALL SIO$OUT$WORD(IP);
178   2              CSIP.SEG = CS;
179   2              CSIP.OFF = IP;
180   2              CALL SIO$OUT$CHAR('-');
181   2              CALL SIO$OUT$BLANK;
182   2              CALL SIO$OUT$BYTE$PTR(MEMORY$CSIP$PTR);
183   2              CALL SIO$OUT$BLANK;
184   2              CALL SIO$GET$CHAR;
185   2              IF CHAR<>',' AND CHAR<>ASCR THEN CALL SIO$GET$ADDR(.CSIP,CS);
187   2      END SIO$UPDATE$IP;

             /************************************
             * DEVICE INITIALIZATION SECTION     *
             ************************************/

188   1      INITIALIZE$BOARD:
                 /* THIS PROCEDURE INITIALIZES THE ISBC 544 BOARD */
                 PROCEDURE;

189   2      PI$INIT:        /* 8155 PARALLEL INTERFACE INITIALIZATION */
                 OUTPUT(PI$CMD) = PI$INIT$CMD1;
190   2              OUTPUT(PI$PORTA) = PI$INIT$SIO$INT1;
191   2              CALL SIO$MS$DELAY(100);
192   2              OUTPUT(PI$PORTA) = PI$INIT$SIO$INT2;
193   2              CALL SIO$MS$DELAY(100);
194   2              OUTPUT(PI$CNTR$LO) = PI$CNTR$LOCNT;
195   2              OUTPUT(PI$CNTR$HI) = PI$CNTR$HICNT;
196   2              OUTPUT(PI$CMD) = PI$INIT$CMD2;

197   2      US$INIT:        /* INITIALIZE THE USARTS */
                 OUTPUT(SIO$P0$CMD) = SIO$MODE;
198   2              OUTPUT(SIO$P0$CMD) = SIO$COMMAND;
199   2              OUTPUT(SIO$P1$CMD) = SIO$MODE;
200   2              OUTPUT(SIO$P1$CMD) = SIO$COMMAND;
201   2              OUTPUT(SIO$P2$CMD) = SIO$MODE;
202   2              OUTPUT(SIO$P2$CMD) = SIO$COMMAND;
203   2              OUTPUT(SIO$P3$CMD) = SIO$MODE;
204   2              OUTPUT(SIO$P3$CMD) = SIO$COMMAND;

205   2      IT$INIT:        /* 8253 INTERVAL TIMER INITIALIZATION */
                 OUTPUT(ITI$CONT) = USART$CNTR$M3;
206   2              OUTPUT(ITI$CNTR0) = LOW(BRF);
207   2              OUTPUT(ITI$CNTR0) = HIGH(BRF);
```

```
208   2           OUTPUT(IT1$CONT) = 40H OR USART$CNTR$M3;
209   2           OUTPUT(IT1$CNTR1) = LOW(BRF);
210   2           OUTPUT(IT1$CNTR1) = HIGH(BRF);
211   2           OUTPUT(IT1$CONT) = 80H OR USART$CNTR$M3;
212   2           OUTPUT(IT1$CNTR2) = LOW(BRF);
213   2           OUTPUT(IT1$CNTR2) = HIGH(BRF);
214   2           OUTPUT(IT2$CONT) = USART$CNTR$M3;
215   2           OUTPUT(IT2$CNTR0) = LOW(BRF);
216   2           OUTPUT(IT2$CNTR0) = HIGH(BRF);

217   2       IC$INIT:        /* 8259 INTERRUPT CONTROLLER INITIALIZATION */

              /*THE FOLLOWING CODE INITIALIZES THE 8259A. THE INTERRUPTS ARE NOT
              USED FOR THIS MONITOR. ALL INTERRUPTS ARE SET MASKED. */

              OUTPUT(IC$PORTA) = IC$ICW1;
218   2           OUTPUT(IC$PORTB) = IC$ICW2;
219   2           OUTPUT(IC$PORTB) = IC$ICW3;
220   2           OUTPUT(IC$PORTB) = IC$ICW4;
221   2           OUTPUT(IC$PORTB) = IC$MASK;
222   2           OUTPUT(IC$PORTA) = IC$EOI;
223   2           OUTPUT(IC$PORTA) = IC$OCW3;

              /* INITIALIZE INTERRUPT VECTORS */
              /*  CALL INIT$INT$VECTOR(.INT$VECTOR(1),.INTERRUPT1$ENTRY);
              CALL INIT$INT$VECTOR(.INT$VECTOR(2),.INTERRUPT3$ENTRY);
              CALL INIT$INT$VECTOR(.INT$VECTOR(3),.INTERRUPT3$ENTRY);
              DO I = 32 TO 39;
                  CALL INIT$INT$VECTOR(.INT$VECTOR(I),.INTERRUPT32$ENTRY);
              END;
              */
              /*  INT3$PTR = INT$VECTOR(3);  SAVE VECTOR 3 */

224   2       END INITIALIZE$BOARD;

225   1       SIO$RESET$PO$CMD:
              /* THIS PROCEDURE RESETS THE 8251A USART FOR PORT 0 */
              PROCEDURE;
226   2           OUTPUT(SIO$PO$CMD) = SIO$MODE;
227   2           CHAR = 0; /*DELAY*/
228   2           OUTPUT(SIO$PO$CMD) = SIO$RESET$CMD;
229   2           CHAR = 0; /* DELAY */
230   2           OUTPUT(SIO$PO$CMD) = SIO$MODE;
231   2           CHAR = 0; /*DELAY*/
232   2           OUTPUT(SIO$PO$CMD) = SIO$COMMAND;
233   2       END SIO$RESET$PO$CMD;

234   1       SIO$INIT$MODE:
              /* INITIALIZES THE PORT 0 USART DATA RATE TO BRF */
              PROCEDURE;
235   2           CALL SIO$RESET$PO$CMD;
```

```
 236   2             OUTPUT(IT1$CONT) = USART$CNTR$M3;
 237   2             OUTPUT(IT1$CNTR0) = LOW(BRF);
 238   2             OUTPUT(IT1$CNTR0) = HIGH(BRF);

 239   2     END SIO$INIT$MODE;

             /*****************************************
             * PAPER TAPE, SERIAL, PARALLEL READ SECTION*
             *****************************************/

 240   1     SIO$READ$CHAR:
             /*THIS PROCEDURE READS A CHARACTER FROM PORT 0 USART. */
             PROCEDURE BYTE;
 241   2           DECLARE II ADDRESS;

 242   2     LOOP:
                   DO II = 1 TO MAX$DELAY;
 243   3              IF SIO$CHAR$RDY THEN GOTO READY;
 245   3           END;
 246   2           GOTO ERROR;
 247   2     READY:
                   CALL SIO$CHECK$CONTROL$CHAR;
 248   2           IF CHAR = 11H THEN GOTO LOOP; /* GET ANOTHER IF CTL-Q */
 250   2           RETURN CHAR;
 251   2     END SIO$READ$CHAR;

 252   1     SIO$READ$BYTE:
             /* THIS ROUTINE READS TWO HEX BYTES AND RETURNS THEIR BINARY
                BYTE VALUE. */
             PROCEDURE BYTE;
 253   2           DECLARE T BYTE;
 254   2           T = LOW(SIO$HEX(SIO$READ$CHAR));
 255   2           T = SHL(T,4) + LOW(SIO$HEX(SIO$READ$CHAR));
 256   2           CHECK$SUM = CHECK$SUM + T;
 257   2           RETURN T;
 258   2     END SIO$READ$BYTE;

 259   1     SIO$READ$WORD:
             /* THIS ROUTINE READS FOUR HEX BYTES AND RETURNS THEIR BINARY
                ADDRESS VALUE. */
             PROCEDURE ADDRESS;
 260   2           DECLARE T BYTE;
 261   2           T = SIO$READ$BYTE;
 262   2           RETURN SHL(DOUBLE(T),8) + DOUBLE(SIO$READ$BYTE);
 263   2     END SIO$READ$WORD;

 264   1     SIO$READ$HEX$FILE:
             /* THIS ROUTINE IS CALLED BY THE READ COMMAND TO
                READ A HEX FILE. */
             PROCEDURE;
 265   2           DECLARE (REC$TYPE,LEN,I,T) BYTE, OFFSET ADDRESS;
```

```
266   2             IF CHAR <> ASCR THEN
267   2                  CALL SIO$GET$ADDR(.ARG2,0); /* GET BIAS ADDR */
                      ELSE
268   2                  ARG2.SEG,ARG2.OFF = 0;
269   2             ARG1.SEG = ARG2.SEG;     /* SEGMENT FOR 8080 FORMAT FLE */
270   2             IF CHAR<>ASCR THEN GOTO ERROR;
272   2             CALL SIO$CRLF;
273   2       LOOP:
                   DO WHILE SIO$READ$CHAR<>':';END;
275   2             CHECK$SUM = 0;
276   2             LEN = SIO$READ$BYTE;
277   2             OFFSET = SIO$READ$WORD;
278   2             ARG1.OFF = OFFSET + ARG2.OFF;
279   2             REC$TYPE = SIO$READ$BYTE;
280   2             IF REC$TYPE=03 THEN  /* START ADDR TYPE */
281   2                  DO;
282   3                  CS = SIO$READ$WORD;
283   3                  IP = SIO$READ$WORD;
284   3                  END;
285   2             IF REC$TYPE=02 THEN       /* EXTENDED ADDR TYPE */
286   2                 ARG1.SEG = SIO$READ$WORD + ARG2.SEG;
287   2             IF REC$TYPE=01 THEN
288   2                  IF OFFSET <> 0 THEN
289   2                       IP = OFFSET;            /* EOF RECOPD */
290   2             IF REC$TYPE=00 THEN     /* DATA TYPE */
291   2                  DO I =1 TO LEN;
292   3                       MEMORY$ARG1 = SIO$READ$BYTE;
293   3                       T = MEMORY$ARG1;
294   3                       IF MEMORY$ARG1<>T THEN
295   3                            DO;
296   4                            CALL SIO$OUT$STRING(.MEM$RW$ERR);
297   4                            CALL SIO$CRLF;
298   4                            GOTO ERROR;
299   4                            END;
300   3                       ARG1.OFF = ARG1.OFF + 1;
301   3                  END;
302   2             T = SIO$READ$BYTE;     /* FETCH CHECKSUM */
303   2             IF CHECK$SUM<>0 THEN
304   2                  DO;
305   3                  CALL SIO$OUT$STRING(.CHECK$SUM$ERR$MSG);
306   3                  GOTO ERROR;
307   3                  END;
308   2             IF REC$TYPE<>01 AND LEN<>0 THEN GOTO LOOP;  /* EOF */
310   2             MODE = SERIAL;
311   2              CALL SIO$OUT$STRING(.START$MSG);
312   2              CALL SIO$OUT$WORD(IP);
313   2              CALL SIO$CRLF;

314   2       END SIO$READ$HEX$FILE;
```

```
                /*****************************************
                * INTERRUPT AND RESTORE/EXECUTE SECTION     *
                *****************************************/



                /*****************************************************************
                                    COMMAND MODULE
                                  ==============
                ABSTRACT
                ========
                THIS MODULE CONTAIN ALL THE COMMANDS IMPLEMENTED AS INDIVIDUAL PROCEDURES
                AND CALLED FROM THE OUTER BLOCK OF THE COMMAND DISPATCH LOOP.

                MODULE ORGANIZATION
                ===================
                THIS MODULE CONTAIN THE FOLLOWING SECTIONS:

                    1.  COMMANDS SECTION
                        SIO$GO          GO
                        SIO$EXAM$MEM    SUBSTITUTE MEMORY
                        SIO$MOVE        MOVE
                        SIO$DISPLAY     DISPLAY BYTES
                        SIO$COMPARE     COMPARE MEMORY
                        SIO$FIND        FIND BYTE/ADDRESS
                        SIO$HEX$ARITH   PERFORM HEX ARITHMETIC
                        SIO$INPUT       INPUT PORT
                        SIO$OUTPUT      OUTPUT PORT
                        SIO$READ        READ DATA RECORDS
                        SIO$LOAD        LOAD FILE
                        SIO$FILL        FILL MEMORY WITH CONSTANT

                    2.  COMMAND DISPATCH (OUTER BLOCK, MAIN PROGRAM LOOP)
                        NEXT$COMMAND        DISPATCH
                        ERROR           ERROR ROUTINE
                */
                   /*******************************
                   *        COMMAND SECTION       *
                   *******************************/

315   1        SIO$GO:
                  /* IMPLEMENTS THE 'GO' COMMAND. THE USER MAY SPECIFY A NEW
                     IP:PC                                                  */
                  PROCEDURE;
316   2           DECLARE EXECGO(*) BYTE DATA
                      ( 060H,         /* MOV H,B */
                        069H,         /* MOV L,C */
                        0E9H  ),      /* PCHL    */
                    EXECGO$PTR ADDRESS DATA (.EXECGO);

317   2           CALL SIO$UPDATE$IP;
318   2           IF CHAR <> ASCR THEN GOTO ERROR;
```

```
320   2          IP = CSIP.OFF;
321   2          CS = CSIP.SEG;
322   2          CALL SIO$CRLF;
323   2          CALL EXECGO$PTR(IP);

324   2      END SIO$GO;

325   1      SIO$EXAM$MEM:
               /* IMPLEMENTS THE EXAMINE MEMORY COMMAND. */
               PROCEDURE;
326   2          DECLARE W ADDRESS;

327   2          CALL SIO$TEST$WORD$MODE;
328   2          CALL SIO$GET$ADDR(.ARG1,CS);
329   2          IF CHAR<>',' THEN GOTO ERROR;
331   2          DO WHILE TRUE;
332   3             CALL SIO$OUT$BLANK;
333   3             IF WORD$MODE THEN
334   3                 CALL SIO$OUT$WORD(MEMORY$ADDRESS$ARG1);
                   ELSE
335   3                 CALL  SIO$OUT$BYTE$PTR(MEMORY$ARG1$PTR);
336   3             CALL SIO$OUT$CHAR('-');
337   3             CALL SIO$OUT$BLANK;
338   3             CALL SIO$GET$CHAR;
339   3             IF CHAR=ASCR THEN RETURN;
341   3             IF CHAR<>',' THEN
342   3                 DO;
343   4                 W = SIO$GET$WORD;
344   4                 IF (CHAR <> ',') AND (CHAR <>ASCR) THEN GOTO ERROR;
346   4                 IF WORD$MODE THEN
347   4                     DO;
348   5                     MEMORY$ADDRESS$ARG1 = W;
349   5                     IF MEMORY$ADDRESS$ARG1<>W THEN GOTO ERROR;
351   5                     END;
                      ELSE
352   4                     DO;
353   5                     MEMORY$ARG1 = LOW(W);
354   5                     IF MEMORY$ARG1<>LOW(W) THEN GOTO ERROR;
356   5                     END;
357   4                 END;
358   3             IF CHAR=ASCR THEN RETURN;
360   3             IF WORD$MODE THEN
361   3                 ARG1.OFF = ARG1.OFF + 2;
                   ELSE
362   3                 ARG1.OFF = ARG1.OFF + 1;
363   3             CALL SIO$CRLF;
364   3             CALL SIO$OUT$WORD(ARG1.OFF);
365   3          END;
366   2      END SIO$EXAM$MEM;

367   1      SIO$MOVE:
```

```
                    /* IMPLEMENTS THE MOVE COMMAND. ACCEPTS 3 ARGUMENTS AND MOVES THE
                       BLOCK OF MEMORY SPECIFIED BY ARG1-ARG2 TO ARG3. ARG2<ARG1 OR THERE
                       IS A DIFFERENCE WHEN THE BYTE IS READ BACK, THEN ERROR. */
                    PROCEDURE;

368   2             CALL SIO$SCAN$BLANK;
369   2             CALL SIO$GET$ADDR(.ARG1,CS);     /* FIRST ARGUMENT */
370   2             IF CHAR<>',' THEN GOTO ERROR;
372   2             CALL SIO$GET$CHAR;
373   2             END$OFF = SIO$GET$WORD;          /* SECOND ARGUMENT */
374   2             IF END$OFF<ARG1.OFF THEN GOTO ERROR;
376   2             IF CHAR<>',' THEN GOTO ERROR;
378   2             CALL SIO$GET$CHAR;
379   2             CALL SIO$GET$ADDR(.ARG3,CS);     /* THIRD ARGUMENT */
380   2             IF CHAR<>ASCR THEN GOTO ERROR;
382   2             CALL SIO$CRLF;
383   2             DO WHILE ARG1.OFF <= END$OFF;
384   3                 MEMORY$ARG3 = MEMORY$ARG1;
385   3                 IF MEMORY$ARG3<>MEMORY$ARG1 THEN GOTO ERROR;
387   3                 ARG1.OFF = ARG1.OFF + 1;
388   3                 ARG3.OFF = ARG3.OFF + 1;
389   3             END;

390   2         END SIO$MOVE;

391   1         SIO$DISPLAY:
                    /* IMPLEMENTS THE DISPLAY BYTE COMMAND. IF CALLED WITH 1 PARM THEN
                       OUTPUTS A SINGLE BYTE. IF CALLED WITH 2 PARMS THEN OUTPUTS THE RANGE
                       BETWEEN THE TWO ADDRESSES.  IF OFFSET<BEGIN THEN OUTPUTS ONLY A SINGLE
                       BYTE. */
                    PROCEDURE;
392   2                 DECLARE (X,Y) BYTE,
                              T ADDRESS;

393   2                 ARG2.OFF, ARG2.SEG = 0;
394   2                 CALL SIO$GET$CHAR;
395   2                 CALL SIO$GET$ADDR(.ARG1,CS);
396   2                 IF CHAR=ASCR THEN
397   2                     END$OFF = ARG1.OFF;
                        ELSE
398   2                     DO;
399   3                     IF CHAR<>',' THEN GOTO ERROR;
401   3                     CALL SIO$GET$CHAR;
402   3                     END$OFF = SIO$GET$WORD;
403   3                     IF END$OFF < ARG1.OFF THEN GOTO ERROR;
405   3                     IF CHAR <> ASCR THEN GOTO ERROR;
407   3                     END;
408   2         NEWLINE:
                            ARG2.OFF = ARG1.OFF;
409   2                     CALL SIO$CRLF;
410   2                     CALL SIO$OUT$WORD(ARG1.OFF);
```

```
411   2             CALL SIO$OUT$BLANK;
412   2             Y = 0;
413   2       LOOP:
                    CALL SIO$OUT$BYTE$PTR(MEMORY$ARG1$PTR);
414   2             IF ARG1.OFF >= END$OFF THEN
415   2                 DO;
416   3                 ARG1.OFF = ARG1.OFF + 1;
417   3                 T = 0;
418   3                 GOTO LOOP1;
419   3                 END;
420   2             ARG1.OFF = ARG1.OFF + 1;
421   2             Y = Y + 1;
422   2             IF Y >= 4 THEN
423   2                 DO;
424   3                 CALL SIO$OUT$BLANK;
425   3                 Y = 0;
426   3                 END;
427   2             T = ARG1.OFF AND 000FH;
428   2       LOOP1:
                    IF T=0 THEN
429   2                 DO;
430   3                 CALL SIO$OUT$BLANK;
431   3                 CALL SIO$OUT$CHAR('*');
432   3                 DO WHILE ARG2.OFF <= (ARG1.OFF - 1);
433   4                     X = MEMORY$ARG2 AND 7FH;
434   4                     IF (X >= ASBL) AND (X <= 7EH) THEN
435   4                         CALL SIO$OUT$CHAR(X);
                          ELSE
436   4                         CALL SIO$OUT$CHAR('.');
437   4                     ARG2.OFF = ARG2.OFF + 1;
438   4                 END;
439   3                 CALL SIO$OUT$CHAR('*');
440   3                 IF ARG1.OFF >= END$OFF THEN RETURN;
442   3                 GOTO NEWLINE;
443   3                 END;
444   2             GOTO LOOP;

445   2       END SIO$DISPLAY;

446   1       SIO$COMPARE:
                  /* IMPLEMENTS THE COMPARE COMMAND */
                  PROCEDURE;

447   2           CALL SIO$SCAN$BLANK;
448   2           CALL SIO$GET$ADDR(.ARG1,CS);
449   2           IF CHAR <> ',' THEN GOTO ERROR;
451   2           CALL SIO$GET$CHAR;
452   2           END$OFF = SIO$GET$WORD;
453   2           IF END$OFF < ARG1.OFF THEN GOTO ERROR;
455   2           IF CHAR <> ',' THEN GOTO ERROR;
457   2           CALL SIO$GET$CHAR;
```

```
458   2          CALL SIO$GET$ADDR(.ARG3,CS);
459   2          IF CHAR <> ASCR THEN GOTO ERROR;
461   2          CALL SIO$CRLF;
462   2      LOOP:
              DO WHILE ARG1.OFF <= END$OFF;
463   3          IF MEMORY$ARG1 <> MEMORY$ARG3 THEN
464   3              DO;
465   4              CALL SIO$OUT$WORD(ARG1.OFF);
466   4              CALL SIO$OUT$BLANK;
467   4              CALL SIO$OUT$BYTE$PTR(MEMORY$ARG1$PTR);
468   4              CALL SIO$OUT$BLANK;
469   4              CALL SIO$OUT$WORD(ARG3.OFF);
470   4              CALL SIO$OUT$BLANK;
471   4              CALL SIO$OUT$BYTE$PTR(MEMORY$ARG3$PTR);
472   4              CALL SIO$CRLF;
473   4              END;
474   3          ARG1.OFF = ARG1.OFF + 1;
475   3          ARG3.OFF = ARG3.OFF + 1;
476   3          END;
477   2      END SIO$COMPARE;

478   1      SIO$FIND:
             /* IMPLEMENTS THE FIND COMMAND */
             PROCEDURE;
479   2          DECLARE SEARCH$WORD ADDRESS;

480   2          CALL SIO$TEST$WORD$MODE;
481   2          CALL SIO$GET$ADDR(.ARG1,CS);
482   2          IF CHAR <> ',' THEN GOTO ERROR;
484   2          CALL SIO$GET$CHAR;
485   2          END$OF    SIO$GET$WORD;
486   2          IF END$OFF < ARG1.OFF THEN GOTO ERROR;
488   2          IF CHAR <> ',' THEN GOTO ERROR;
490   2          CALL SIO$GET$CHAR;
491   2          SEARCH$WORD = SIO$GET$WORD;
492   2          IF CHAR <> ASCR THEN GOTO ERROR;
494   2          CALL SIO$CRLF;
495   2      LOOP:
              DO WHILE ARG1.OFF <= END$OFF;
496   3          IF WORD$MODE THEN
497   3              DO;
498   4              IF MEMORY$ADDRESS$ARG1 = SEARCH$WORD THEN
499   4                  DO;
500   5                  CALL SIO$OUT$WORD(ARG1.OFF);
501   5                  CALL SIO$CRLF;
502   5                  END;
503   4              END;
                   ELSE
504   3              DO;
505   4              IF MEMORY$ARG1 = LOW(SEARCH$WORD) THEN
506   4                  DO;
```

```
507   5                   CALL SIO$OUT$WORD(ARG1.OFF);
508   5                   CALL SIO$CRLF;
509   5                   END;
510   4                END;
511   3             ARG1.OFF = ARG1.OFF + 1;
512   3          END;
513   2       END SIO$FIND;

514   1       SIO$HEX$ARITH:
                 /* IMPLEMENTS THE HEX ARITHMETIC COMMAND */
                 PROCEDURE;
515   2          DECLARE (W1,W2) ADDRESS;

516   2          CALL SIO$SCAN$BLANK;
517   2          W1 = SIO$GET$WORD;
518   2          IF CHAR <> ',' THEN GOTO ERROR;
520   2          CALL SIO$GET$CHAR;
521   2          W2 = SIO$GET$WORD;
522   2          IF CHAR <> ASCR THEN GOTO ERROR;
524   2          CALL SIO$CRLF;
525   2          CALL SIO$OUT$WORD(W1+W2);
526   2          CALL SIO$OUT$BLANK;
527   2          CALL SIO$OUT$WORD(W1-W2);
528   2       END SIO$HEX$ARITH;

529   1       SIO$FILL:
              /* THIS PROCEDURE IMPLEMENTS THE FILL MEMORY WITH CONSTANT
                 FUNCTION                                              */
              PROCEDURE;
530   2          DECLARE TEMP BYTE;

531   2          CALL SIO$GET$CHAR;
532   2          CALL SIO$GET$ADDR(.ARG1, CS);
533   2          IF CHAR <> ',' THEN GOTO ERROR;
535   2          CALL SIO$GET$CHAR;
536   2          CALL SIO$GET$ADDR(.ARG2, CS);
537   2          IF ARG2.OFF < ARG1.OFF THEN GOTO ERROR;
539   2          IF CHAR <> ',' THEN GOTO ERROR;
541   2          TEMP = SIO$GET$BYTE;
542   2          IF CHAR <> ASCR THEN GOTO ERROR;
544   2          CALL SIO$CRLF;

545   2          DO WHILE ARG1.OFF <= ARG2.OFF;
546   3             MEMORY$ARG1 = TEMP;
547   3             IF MEMORY$ARG1 <> TEMP THEN GOTO ERROR;
549   3             ARG1.OFF = ARG1.OFF + 1;
550   3          END;
551   2       END SIO$FILL;

552   1       SIO$READ:
              /*  THIS PROCEDURE IMPLEMENTS THE PAPER TAPE READ COMMAND */
```

```
                    PROCEDURE;
553   2             CALL SIO$SCAN$BLANK;
554   2             SAVE$MODE = TAPE OR SERIAL;
555   2             CALL SIO$READ$HEX$FILE;
556   2         END SIO$READ;

                  /*****************************************************
                  *          COMMAND DISPATCH MAIN PROGRAM LOOP         *
                  *****************************************************/

                    /* THE RST 5.5, 6.5, AND 7.5 ARE DISABLED
                    BY USING A SYSTEM CALL WITH THE PARTICULAR
                    SIM MASK AS THE PARAMETER. */

557   1             DISABLE;
558   1             CALL S$MASK(01FH);  /* DISABLE RST 5.5, 6.5, 7.5, SOD */

559   1             MONITOR$STACKPTR = STACKPTR;
560   1             CS,IP = 0;
561   1             WORD$MODE = FALSE;
562   1             MODE = SERIAL;
563   1             BRF = B9600;

                    /*  THE FOLLOWING CODE SETS THE DATA RATE OF PORT 0. IT
                    INITIALIZES BOTH THE 8251A USART AND COUNTER 0 OF 8253
                    INTERVAL TIMER # 0. USARTS 1, 2, AND 3 ARE NOT USED FOR
                    THIS MONITOR. */

564   1             CALL INITIALIZE$BOARD;
565   1             CHAR = INPUT(SIO$P0$DATA);
566   1             CALL SIO$OUT$STRING(.SIGNON$MSG);

567   1         NEXT$COMMAND:

                     /* THIS IS THE PERPETUAL COMMAND LOOP WHICH DISPATCHES TO EACH
                    COMMAND, EACH OF WHICH IS A SEPARATE PROCEDURE. */

                    CALL SIO$CRLF;
568   1             CALL SIO$OUT$CHAR('-');
569   1             CALL SIO$GET$CHAR;
570   1             DO I=0 TO LAST(SIO$CMND);
571   2                 IF CHAR=SIO$CMND(I) THEN GOTO DISPATCH;
573   2             END;
574   1             GOTO ERROR;
575   1         DISPATCH:
                    LAST$COMMAND = I;
576   1             DO CASE I;
577   2                 CALL SIO$EXAM$MEM;      /* S */
578   2                 CALL SIO$GO;            /* G */
579   2                 CALL SIO$MOVE;          /* M */
580   2                 CALL SIO$DISPLAY;       /* D */
```

```
 581   2              CALL SIO$COMPARE;       /* C */
 582   2              CALL SIO$FIND;          /* F */
 583   2              CALL SIO$HEX$ARITH;     /* H */
 584   2              CALL SIO$READ;          /* R */
 585   2              CALL SIO$FILL;          /* Z */
 586   2          END;
 587   1          GOTO NEXT$COMMAND;

 588   1      ERROR:

                  /* THIS ROUTINE HANDLES ALL ERRORS DETECTED BY THE MONITOR AND
                 WILL OUTPUT THE ERROR PROMPT TO THE OUTPUT PORT. */

                     MODE = SERIAL;
 589   1              STACKPTR = MONITOR$STACKPTR;
 590   1              CALL SIO$OUT$CHAR('#');
 591   1              CALL SIO$MS$DELAY(50);
 592   1              GOTO NEXT$COMMAND;

 593   1      END MONITOR;        /* END OF MODULE */


MODULE INFORMATION:

     CODE AREA SIZE     = 0CD8H   3288D
     VARIABLE AREA SIZE = 006BH    107D
     MAXIMUM STACK SIZE = 0012H     18D
     1131 LINES READ
     0 PROGRAM ERROR(S)

END OF PL/M-80 COMPILATION
```

VITA

Creed F. Childress, Jr., was born on 7 October 1943 in Santa Barbara, California. He graduated from South Lake Tahoe High School in 1961. He then attended the University of California at Berkeley, California State University at Sacramento, and the University of California at Santa Barbara before enlisting in the U.S. Air Force in October 1966 when he began training as a Radio Relay Maintenance Technician. After his initial training, he was assigned to the 2063 Communications Group at Lindsey Air Station, Wiesbaden, Germany, where in 1972, he was accepted into the Airmen Education and Commissioning Program. He attended the University of Michigan, Ann Arbor, Michigan, and graduated in May 1974 with a Bachelor of Science in Industrial and Operations Engineering and a Bachelor of Science in Electrical Engineering. He then attended Officer Training School and was commissioned in August 1974 and assigned to Keesler Technical Training Center, Keesler AFB, Mississippi, for further training in the Communications Engineer specialty. His next assignment began in June 1975 as an instructor in the Wideband Systems Evaluation School (AFCC) at Richards-Gebaur AFB, Grandview, Missouri. In November 1977, he was assigned as the Detachment Commander of Detachment 27 of the 2187 Communications Group in Martina Franca, Italy. Following that challenging assignment, he was assigned to the Plans Division of the Headquarters of the Air Force Operational Test and Evaluation Center, Kirtland AFB, New Mexico in December 1979. He entered the Air Force Institute of Technology in May 1983.

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REPORT DOCUMENTATION PAGE

PORT SECURITY CLASSIFICATION UNCLASSIFIED	1b. RESTRICTIVE MARKINGS
CURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release; distribution unlimited.
CLASSIFICATION/DOWNGRADING SCHEDULE	
FORMING ORGANIZATION REPORT NUMBER(S) T/GE/ENG/84D-17	5. MONITORING ORGANIZATION REPORT NUMBER(S)
ME OF PERFORMING ORGANIZATION ool of Engineering — 6b. OFFICE SYMBOL (If applicable) AFIT/EN	7a. NAME OF MONITORING ORGANIZATION
DDRESS (City, State and ZIP Code) Force Institute of Technology ght Patterson AFB, OH 45433	7b. ADDRESS (City, State and ZIP Code)
ME OF FUNDING/SPONSORING ORGANIZATION — 8b. OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
DDRESS (City, State and ZIP Code)	10. SOURCE OF FUNDING NOS. PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO. / WORK UNIT NO.
TLE (Include Security Classification) Box 19	
RSONAL AUTHOR(S) Box 19	
TYPE OF REPORT Thesis — 13b. TIME COVERED FROM ____ TO ____	14. DATE OF REPORT (Yr., Mo., Da) 1984 December — 15. PAGE COUNT 331
UPPLEMENTARY NOTATION	

COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
LD	GROUP	SUB. GR.	Local Area Networks, Network Interfac Protocols, UNID, ISO Reference Model, X.25, X.12, TCP/IP, Programming Language, Pascal Language, ...
9	05		

BSTRACT (Continue on reverse if necessary and identify by block number)

Title: CONTINUED DEVELOPMENT AND IMPLEMENTATION OF THE UNIVERSAL NEWORK INTERFACE DEVICE (UNID) II IN THE DIGITAL ENGINEERING LABORATORY NETWC: (DELNET)

Thesis Advisor: Dr. Gary Lamont

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Approved for public release: IAW AFR 190-17.
LYNN E. WOLAVER 21 Feb 85
Dean for Research and Professional Development
Air Force Institute of Technology (AIC)
Wright Patterson AFB OH 45433

ISTRIBUTION/AVAILABILITY OF ABSTRACT LASSIFIED/UNLIMITED ☒ SAME AS RPT. ☐ DTIC USERS ☐	21. ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED
NAME OF RESPONSIBLE INDIVIDUAL Dr Gary Lamont	22b. TELEPHONE NUMBER (Include Area Code) 513-255-3576 — 22c. OFFICE SYMBOL AFIT/EN

Block 19 (cont)

Abstract

This research effort describes the continued development of an improved Universal Network Interface Device (UNID II). The UNID II's architecture was based on a preliminary design project at the Air Force Institute of Technology. The UNID II contains two main hardware modules; a local module for the network layer software and a network module for the datalink layer software and physical layer interface. Each modue is an independent single board computer (SBC) residing on an Intel multibus chassis, complete with its own memory (EPROM and RAM), serial link interfaces, and multibus interface. The local module is an iSBC 544and the network module is an SBC 88/45. The network layer softwaresupports the CCITT X.25 protocol, datagram option, and the data link layr software supports the CCITT X.25 LAPB (HDLC) protocol. This report dcuments the detailed hardware and software design, integration, validatin and test of this system. Upgrade to supplied keywords included. → front p.

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